VOL. XIII, No. 3 SEPTEMBER, 1949

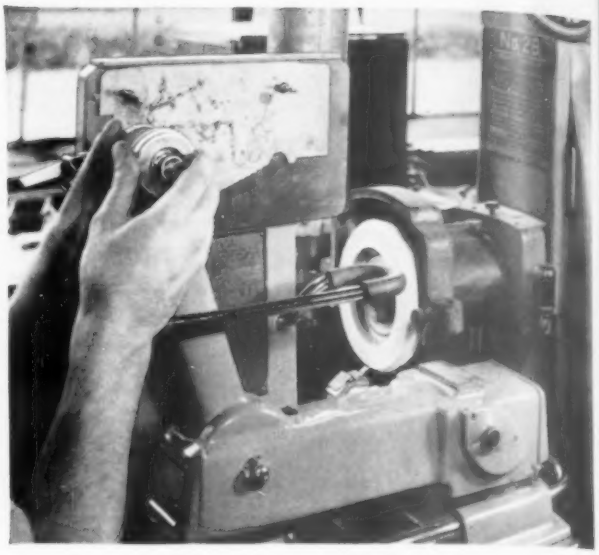
THE TOOL ENGINEER

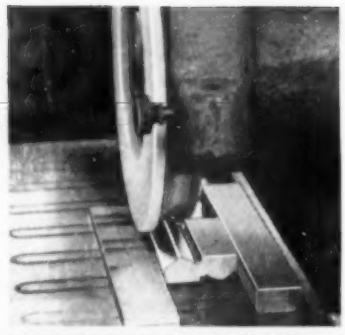
OFFICIAL PUBLICATION: AMERICAN SOCIETY OF TOOL ENGINEERS

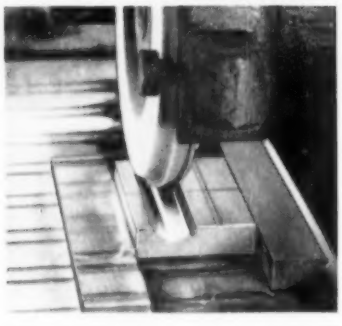
Departments

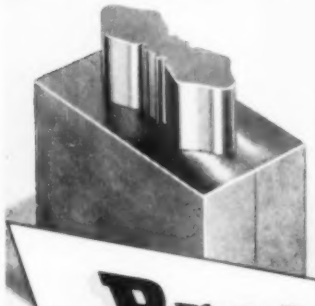
Behind every manufactured product is the tool engineer

FORM-GRINDING TO NEW STANDARDS OF ACCURACY









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for low cost, precision
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Official Publication: American Society of Tool Engineers

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September, 1949

Vol. XXIII, No. 3

A Dedication to American Industry

AS A CANADIAN, it has always struck me as strange that in the country which is chiefly noted for its production genius, the man primarily responsible for it is so little recognized.

Possibly that is because the production man has been so intent on developing those techniques which have made the nation so great in this field that he has had no time to talk about it to others. Like the air around us that we breathe, he is accepted as essential, but is little known, and not at all understood.

People have been making things for ages. There is nothing new about that. But, it is only within the last quarter of a century that the pressure has become so great to manufacture complex articles in volume at low cost for mass consumption that it has been necessary to develop a whole new science to cope with it—the science of Tool Engineering.

Tool Engineering is the science of making things accurately at lowest cost in the shortest possible time. Making things is an *art*. Making them economically is a *science*.

The Tool Engineers Handbook now being introduced is the first comprehensive record of that science.

In 1942, our young Society, which is the professional representative body of that newly developing science, felt that the time had come when it was first possible to organize that knowledge. We realized that within our membership of nearly 18,000 engineers we collectively possessed the knowledge and decided to assemble it and publish it in Handbook form.

Four hundred and fifty men worked for five years. The Society spent $150,000.00 and the publishers nearly an equal amount. This was for administrative and mechanical expenses only and takes no recognition of the material of the contents, which was voluntarily contributed by these men, and which could not be bought at any price.

This was the first time this type of project had been tackled in just this way. It was like trying to produce a battleship or a bomber with the design and engineering staffs being spread across the country and every piece being produced by separate contractors in different cities.

At the beginning, not even the extent of our field was realized. A one and a half year period was required to develop a table of contents and a synopsis of each section to serve as a foundation on which to build.

The selection of authors required a survey of the best brains of our profession. We sought them out everywhere: manufacturers in various industries, technical societies and publications, universities, consulting engineers, machine tool manufacturers, and special equipment producers.

The single feature that strikes one most forcibly about the project was the magnificent generosity with which this large number of men responded and donated of their experience and their time, wholeheartedly, that others might benefit.

This book is actually the gift of American Industry to the American Public. As a Society, we are just the transmitting line.

American Industry has been much maligned and even prosecuted for its selfishness. This book is its vindication. It is not merely a collection of engineering data. It is the outright gift of American Industry's most priceless resource—its "know-how"—to all men of all nations.

R. B. Douglas

President 1948-49

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription, $3.00. Non-members, $6.00. Canada, $6.50; all other foreign countries, $8.00 per year.
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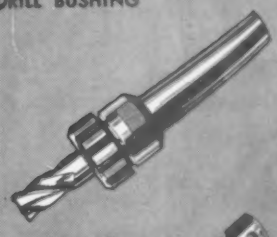
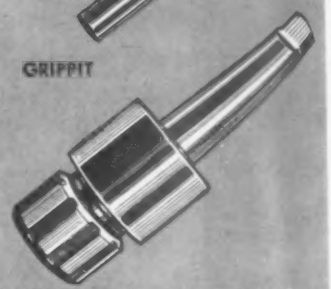
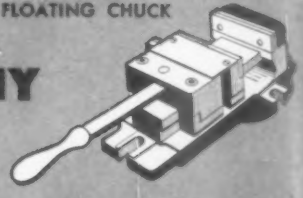


STANDARD COLLET CHUCK

GRIPPIT



FLOATING CHUCK



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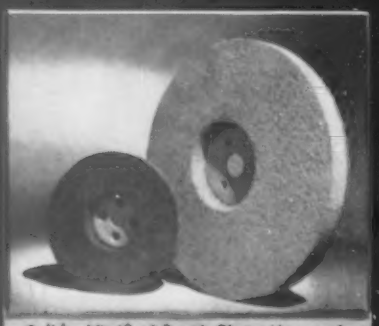
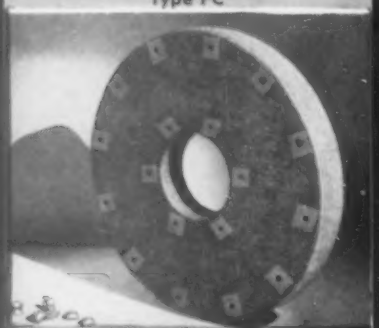
W—1255

NORTON
ABRASIVES



Solid—Vitrified Bond, Plate Mounted, Type PC



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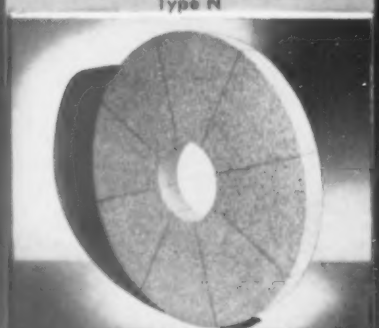

Segmental—Vitrified Bond, Plate Mounted, Type PN

Segmental—Vitrified Bond, Inserted Nut, Type N

Segments—Resinoid Bond, Plate Mounted, Type PC

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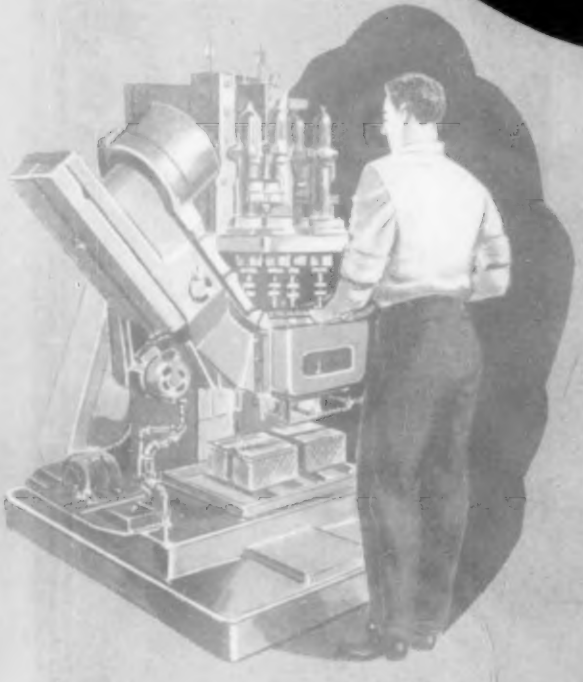

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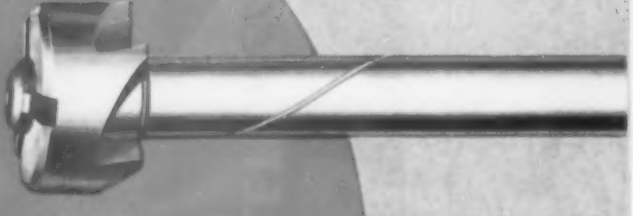

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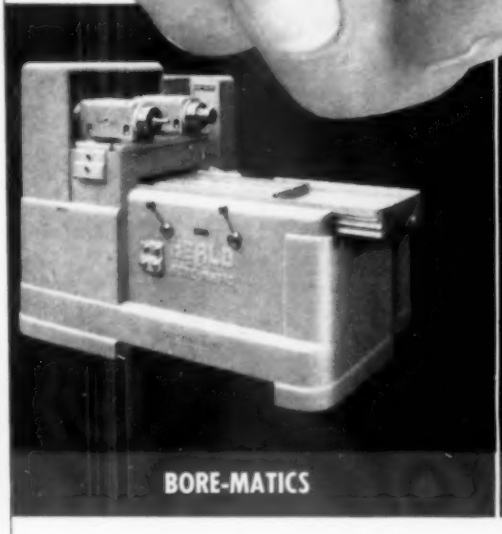
The Heald constant-feed hydraulic system is standard equipment on all new Heald production type machines.



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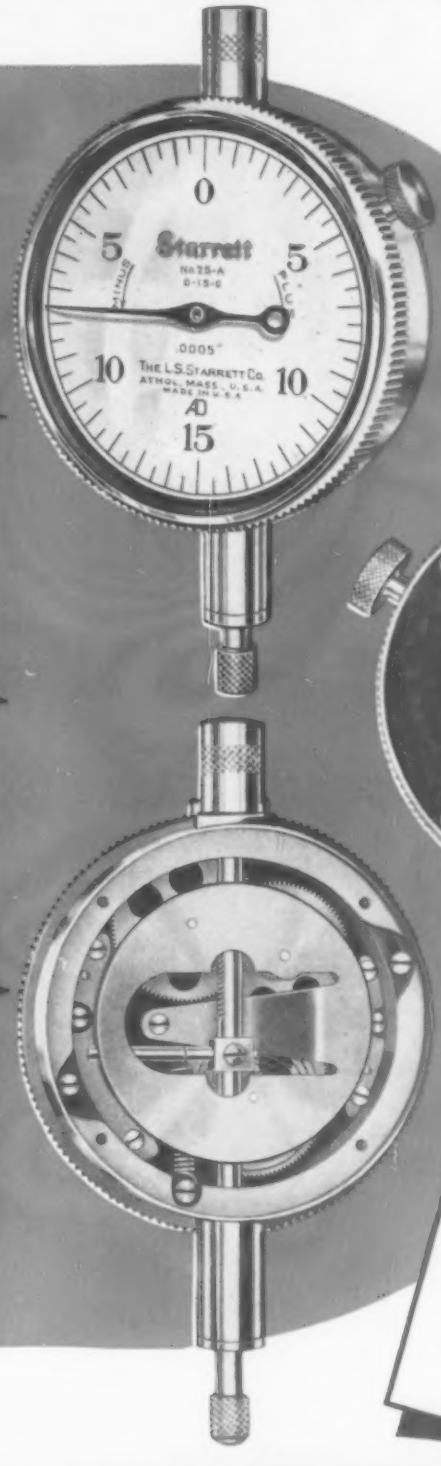

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It speaks for Niagara design, Niagara rigidity, Niagara strength and the recognized ability of Niagara shears to deliver more working strokes per hour.

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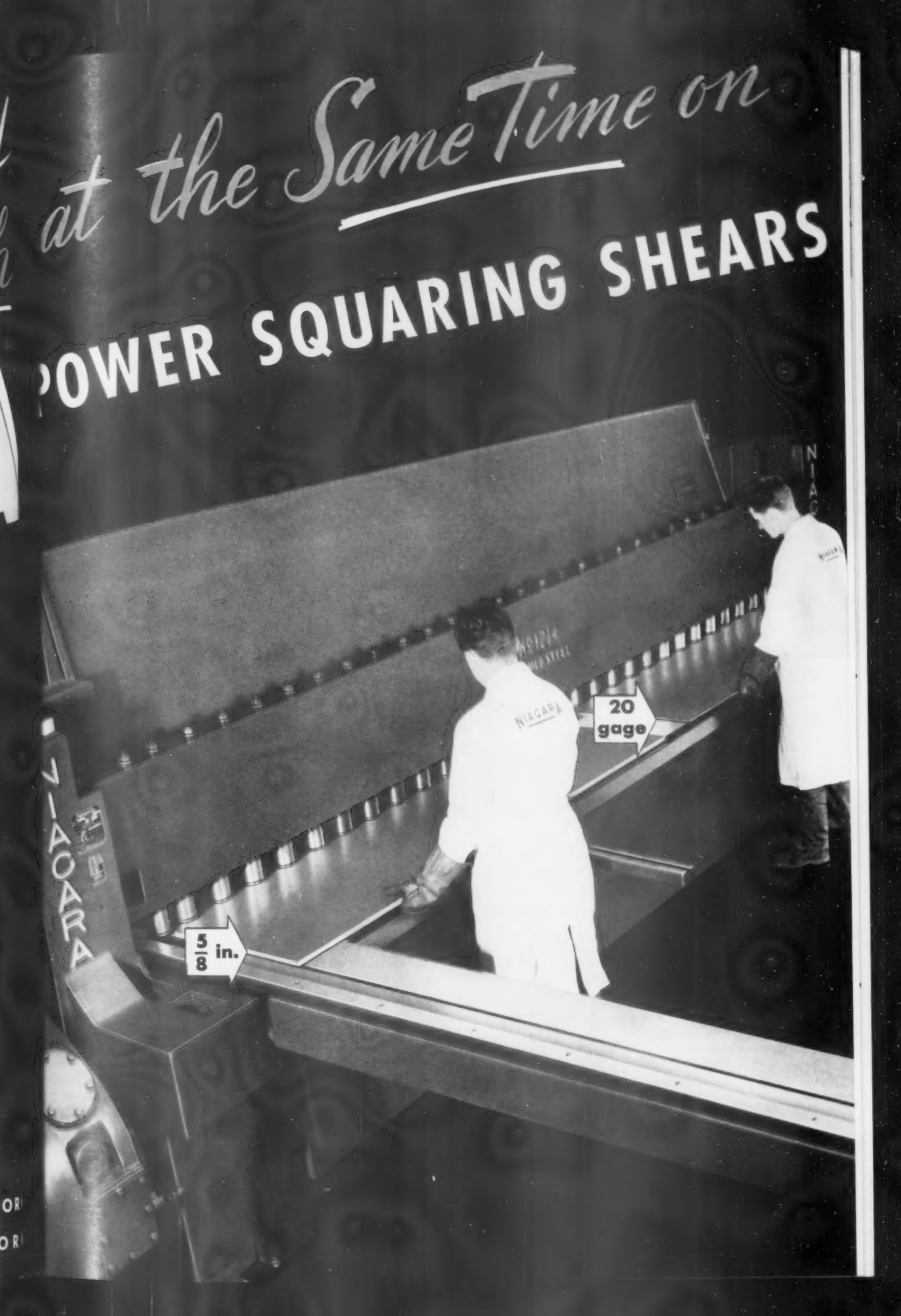
at the Same Time on

POWER SQUARING SHEARS



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By Lester F. Spencer
LANDERS FRARY & CLARK

Setting Up a Statistical Quality Control Program

THE PROBLEM of a quality control procedure involving either production processes or incoming raw materials, is one that is common to all types of manufacturing. Variables within a manufacturing process include raw material selection, basic equipment sensitivity, tooling, skill and workmanship of operators, and quality of supervision. Usually, quality control is on a "Go or No Go" basis, this type of inspection being known as an "inspection of attributes."

In a quality control program which involves an "inspection of variables," not only is a decision made as to the disposition of a group lot in question, but in addition a tabular form is submitted which indicates a range of variation within an established set of standards, enumeration of total rejected items as compared to total items inspected, and number of defects per unit item inspected. An "inspection of variables" involves the use of statistical records to present facts in a simplified manner, and enable the manufacturer to determine the process variability, determine the quality of product at any time in the manufacturing cycle, make sound decisions in manufacturing changes, anticipate impending trouble, and establish tolerances with consideration of the process capability.

Statistical Quality Control Procedures

The most frequently used tool to determine the variation of a submitted lot within a given tolerance limit is the frequency distribution chart. This simple chart can be adapted where one easily measured variable, such as a dimensional factor, a Rockwell hardness number, or a spring extension under a given load is measured. In some cases, a frequency chart is provided by the producer, both as a final check on specification of incoming raw material, and also as a guide for the consumer in determining the degree of inspection of incoming raw material. Fig. 1 illustrates a frequency distribution chart for extension springs purchased, the variable measured being the length of extension of a spring at a given load of 4 oz. On this check list, both the maximum and minimum values are given as agreed upon by the consumer and the producer. As noted, all lots with the exception of lot 7 have been accepted for shipment to the consumer. In this particular lot, not only are the values on the high side within the acceptable range, but in addition 19 percent of the items inspected are above the limits specified. The result was a 100 percent inspection of this particular lot. Although lots 1 and 2 are acceptable for shipment, the values are on the high side, resulting in a possibly more rigid inspection.

A graphical representation of the frequency distribution chart may be made in the form of a frequency histogram, a frequency bar chart or a frequency polygon, (Fig. 2.)

In a statistical control plan, the Shewhart control chart for both averages (bar X or X) and range (R) is widely used. This type of chart is used to (1) determine the level of a quality characteristic, (2) determine possible variation, (3) determine consistency of performance. As an example, in the screw machine part illustrated in Fig. 3, a serious discrepancy in measurement *A* was found. Previous measurements were within the specified dimensional limits. Investigation revealed that the difficulty was due to a compression action during broaching of a new lot of steel. The amount of compression was approximately equal to the increase of thickness as noted in dimension *A* in Fig. 5. Graphically, the two conditions are illustrated in Figs. 4 and 6. In the former instance (Fig. 4), the individual measurement chart indicated 11 percent out of control; the bar X chart indicated that samples 18, 19 and 20 were out of control; and the R chart for range indicated that 18 and 19 were out of control. As a general trend, both the average and range were on the low side of the control bracket. Measure-

Fig. 1. Illustration of a frequency distribution chart indicating values of length of extension spring at 4 oz pull.

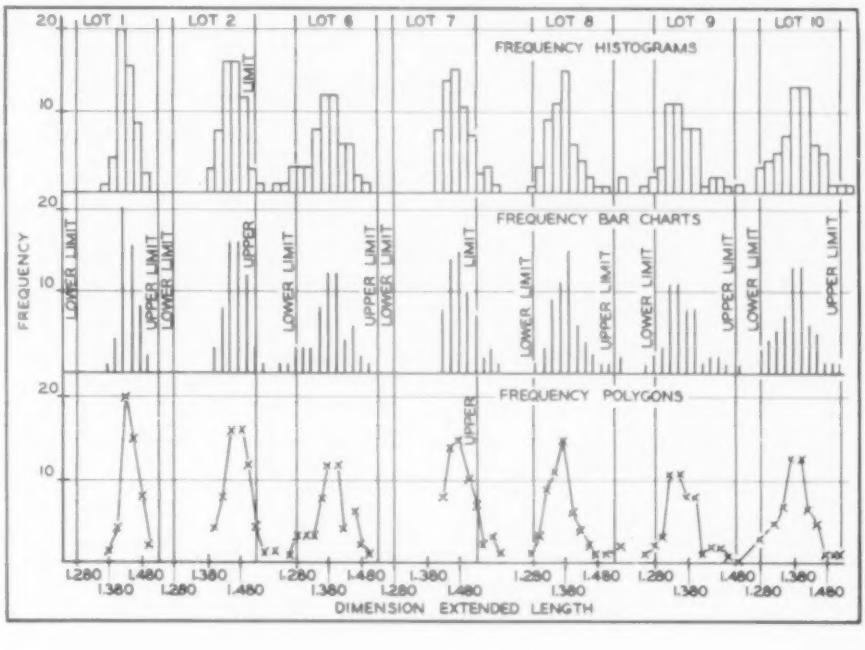
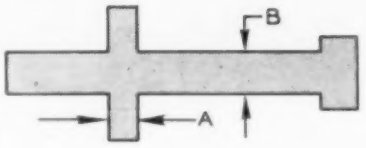


Fig. 2. Frequency histograms (top), frequency bar charts (middle) and frequency polygon curves of the values obtained in Fig. 1.

Fig. 3. Values Obtained on Measurement of Dimension A and Calculation of Bar X and R Values.



Values Expressed in Units of 0.001 inches. Dimensions "A" as Specified 0.045 ± 0.005 inches.

Sample Number	Measurements on each item of five items per hour					Average Bar X	Range R
1	47	45	46	45	47	46.0	2
2	48	47	47	47	46	47.0	2
3	46	48	42	44	43	44.6	6
4	44	46	44	43	47	44.8	4
5	47	45	44	47	48	46.2	4
6	45	44	46	44	46	45.0	2
7	47	48	45	47	46	46.6	3
8	43	42	43	45	44	43.4	3
9	43	47	41	47	46	44.8	6
10	46	45	43	46	44	44.8	3
11	43	42	45	45	45	44.0	3
12	43	44	47	44	45	44.6	4
13	43	44	44	47	42	44.0	5
14	42	44	45	46	41	43.6	5
15	44	45	47	46	45	45.4	3
16	43	44	44	43	41	43.0	3
17	44	43	45	47	48	45.4	5
18	45	48	52	57	43	49.0	12
19	57	58	55	48	41	51.8	17
20	53	58	57	57	55	55.6	5
						9196.0	97

Totals

Double bar X (Grand Average)—45.98
Bar R (Average Range)— 4.85

$UCL_{\bar{X}} = \bar{\bar{X}} + A_2\bar{R} = 45.98 + 0.58(4.85) = 48.79$

$LCL_{\bar{X}} = \bar{\bar{X}} - A_2\bar{R} = 43.17$

$UCL_R = D_2\bar{R} = 2.11(4.85) = 10.23$

$LCL_R = 0$

ments taken after the correction had taken place indicated, graphically, that the individual measurement chart had a figure of 5 percent out of control, this condition rectifying itself as the operation proceeded. However, all measurements were on the high side of the control chart. With regard to the average and range charts, the values were fairly well dispersed.

Also of considerable value is the fractional defective measurement chart, used to good advantage in determining quality levels of sub-contractors. In the example given by E. L. Grant[2], the Niagara Frontier Division of the Bell Aircraft Corporation analyzed acceptance and rejection records covering nearly 35 million parts purchased from 458 companies. Only 1.95 percent of these parts were defective and subsequently rejected, however, an evaluation of vendors' quality performance in terms of average fractional defective revealed the following results:

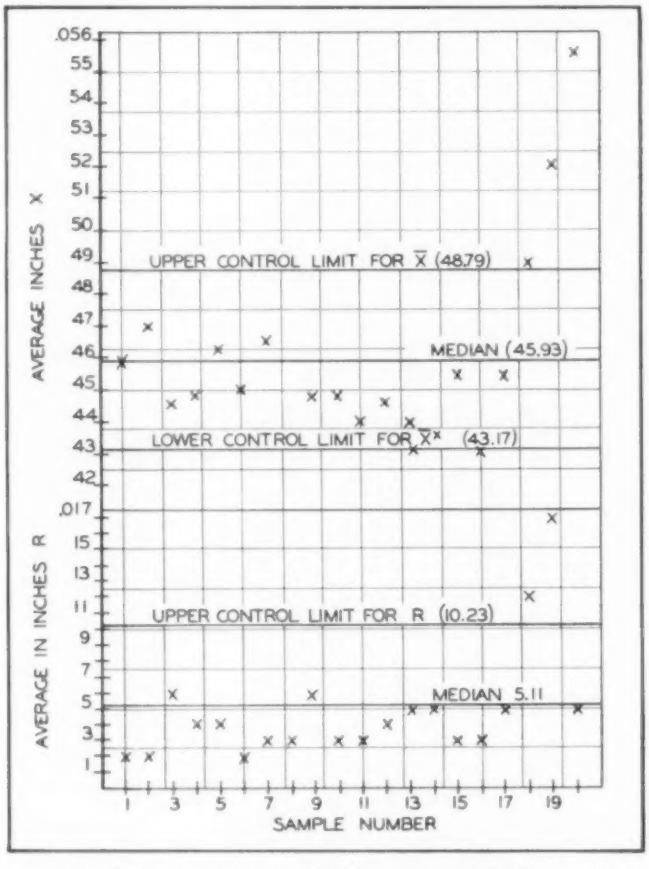
277 companies supplied parts from 0 to 1.99% defective
39 companies supplied parts from 2 to 4.99% defective
31 companies supplied parts from 5 to 9.99% defective
44 companies supplied parts from 10 to 19.99% defective
36 companies supplied parts from 20 to 49.99% defective
31 companies supplied parts from 50 to 100.00% defective

In another instance fractional defective charts indicated graphically a source of difficulty in the tracing of gray iron defectives. The difficulty was in the "as received" casting in the form of hair line cracks, the defect being observed in the machining operation. Investigation with X-ray equipment revealed that an abnormal amount of defective castings were from vendor "C". The cause, which was easily eliminated, was the handling and packing technique for shipment to the consumer. (Consult Figs. 7 and 8.)

Quality Control in Practice

The initial step in the establishment of a quality control program within a plant involves a critical review of the most urgent need within the manufacturing procedure. This may involve control at critical points within a sequence of operational steps required to produce a specific item or within a single department where common operational steps are performed. In the first instance, as an example, a critical review of the operational steps in the manufacture of parachute hardware would reveal that the most probable critical points of inspection would be: (1) inspection procedures on raw materials involving bar stock examination for dimensional tolerances, physical appearance, and/or, surface defects; (2) inspection procedures during a forging operation to determine both dimensional size and die performance; (3) inspection procedures prior to heat treatment; (4) inspection procedures after heat treatment and cleaning to determine physical properties; (5) final inspection after electroplating. In the second instance, a quality control program may be used in a single department, such as a raw material control.

The first consideration in an acceptance inspection method which would involve an "inspection of attributes" is the selection of a sampling procedure. One proven procedure is based on a series of tables prepared by Dodge-Romig[3], which apply to lot sizes up to 100,000 pieces. For any given lot



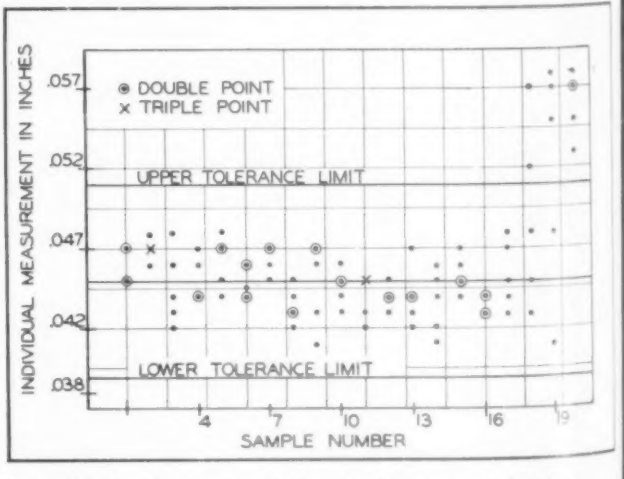


Fig. 4. Shewhart indicating individual measurement of values obtained as illustrated in Fig. 3, as well as the bar X and R chart as calculated

Fig. 5. Measurement Values of Dimension "A" Along with Calculations of Limits After Correction

Values Expressed in Units of 0.001 inches. Dimensions "A" as Specified 0.045 + 0.005 inches.

Sample Number	Measurements on each item of five items per hour					Average Bar X	Range R
1	48	47	47	49	49	48	2
2	50	48	51	47	47	49	4
3	48	47	48	48	48	474	2
4	50	49	49	48	51	494	3
5	51	50	49	47	47	488	4
6	47	48	48	49	48	48	2
7	48	49	49	46	49	482	3
8	50	48	49	49	46	484	4
9	48	47	47	49	47	476	2
10	47	48	47	47	47	472	1
11	47	48	50	46	47	476	4
12	46	47	47	47	46	466	1
13	48	49	50	48	47	484	3
14	48	49	48	50	49	488	2
15	47	48	47	49	49	48	2
						Total 7214	39

$\bar{X} = 48.1$ $\quad R = 2.6$ $\quad UCL_R = 5.49$

$UCL_{\bar{X}} = 5.49$ $\quad LCL\bar{X} = 46.59$ $\quad LCL_R = 0$

size and process average they provide an inspection plan that calls for a minimum total inspection of samples and rejected lots consistent with a given quality assurance. The use of either the single or double sampling plan is dependent upon the characteristics of the individual problem; such as the acceptance or the rejection of a specific lot. In another case, the conditions are such that a decision is reserved until a total rejection of two sample submissions is determined, after which a decision is made.

Of interest is the sampling procedure on incoming bar stock as practiced by the Plomb Tool Co.[4] Rejectable conditions include seams and pits deeper than a pre-determined maxima, scabs, laps, sulfur stringers, machine and handling marks, cracks, scale, rust, twisted and crooked bars. In addition, tolerances and out-of-roundness are determined. From each incoming shipment a pre-determined number of bars is selected at random, the quantity selected being dependent upon the size of the shipment. Acceptance is based upon the fact that a limited number of bars (the Acceptance Number in Fig. 9) may show the above mentioned defects. In a typical inspection plan, the following would be the procedure (Fig. 9):

1. If the number of rejected bars found in the initial sampling exceeds the c_1 value shown in the appropriate column, then an additional sample as shown in the row labeled 'second sample size' is to be selected from the lot.

2. If out of the total of both samples the number of rejected bars exceeds the quantity indicated under c_2, the entire lot or heat is rejected.

3. If the initial inspection shows rejections not exceeding the c_1 value, the entire shipment or heat is considered accepted, with no need for further testing.

4. If the first lot shows rejection as indicated by the value, c_1, and the combined first and second sampling shows rejections not exceeding c_2, lot is considered acceptable.

As one may realize, there will be a distinct differentiation of quality acceptance of individual lots or heats, even though

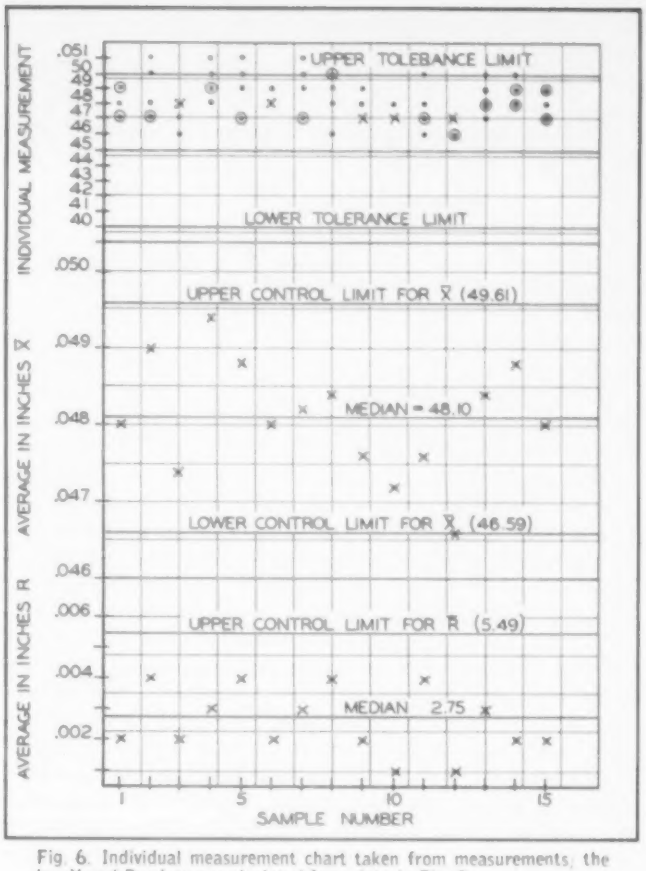


Fig. 6. Individual measurement chart taken from measurements, the bar X and R values as calculated from data in Fig. 5.

all may be acceptable under the standards given. This quality feature is recognized, and for the purpose of differentiation, this company prepares a file card index indicating the storage location, size, and quality characteristic of each lot tested. A quality selection may then be realized in accordance with the requirements of any specific job. Statistical records can be readily made from the information obtained through inspection, especially on the basis of vendors' quality in terms of fractional defective.

One of the main purposes of a quality control program is to establish a minimum sampling procedure, and, subsequently, to reduce the cost of inspection while maintaining quality. Thus, in a quality control program of a stainless steel composition, a reduced sampling technique was realized, the decision of a reduced program being based upon records

Fig. 7. Fractional Defective Chart

Sample No.	Manufacturer "A"			Manufacturer "B"			Manufacturer "C"		
	No. Units Inspected n	No. Units Defective np	Fractional Defective p	No. Units Inspected n	No. Units Defective np	Fractional Defective p	No. Units Inspected n	No. Units Defective np	Fractional Defective
1	35	2	.057	20	2	.10	42	12	.29
2	26	0	0	27	1	.037	27	8	.30
3	30	1	.033	26	0		35	14	.40
4	28	2	.072	26	2	.077	28	11	.39
5	17	0	0	24	1	.042	30	11	.37
6	26	1	.038	24	1	.042	36	12	.33
7	24	0	0	27	2	.074	42	14	.33
8	22	2	0	31	2	.065	39	16	.38
9	24	0	.083	29	1	.035	29	9	.31
10	28	3	.011	30	2	.067	26	12	.46

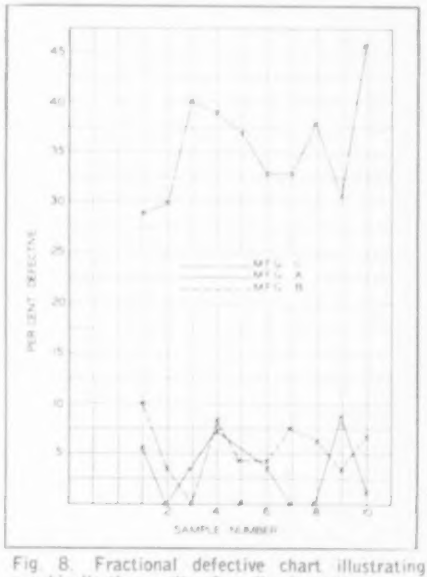


Fig. 8. Fractional defective chart illustrating graphically the results of quality investigation.

Fig. 9. Hot Rolled Bars; Surface Inspection[4]

Sublot Size	500 to 799		800 to 1299		1300 to 3199		3200 to 7999		8000 to 31,999	
First Sample Size	50		75		100		150		200	
Second Sample Size	100		150		200		300		400	
Acceptance Number	c1	c2	c1	c2	c1	c2	c1	c2	c1	c2
	5	12	7	17	10	23	14	33	18	44

of many previous tests. The Army Ordnance and similar organizations operate on a variable acceptance testing program, in that the degree of testing of producer items is based upon the acceptance records of previous tests. Where the average and range (bar X and R values) are established for a specific vendor, test results on the high side of the control range may mean reduced testing, whereas test results on the low side of the control range may mean increased testing.

Such variables as dimensional control in a manufacturing process; electrical conductivity; weights and measures; determination of physical properties such as hardness or tensile strength; case depth differentiation such as obtained through a carburization process; metallographic structure determination—all lend themselves readily to a quality control program. Of these, dimensions are perhaps the most widely controlled factor, and maximum and minimum values are dependent upon such factors as equipment, tooling, raw material, and in some cases, the operator. Automatic equipment holds dimensional tolerances fairly well provided the machine set-up does not change, or, the material characteristics remain constant. Statistical control can establish when either of these two factors deviate and corrections can be made before too much work is rejectable. In manually-operated machines such as the turret lathe where the skill of the operator enters the picture, the third variable is present.

Sampling for dimensional inspection is planned according to the number of pieces within a lot. Measurement of samples may follow a definite pattern, for example, on an automatic screw machine, 10 samples may be taken from production

Fig. 10 Frequency chart of latch bar; variable is the cut length.

every hour. Results may be statistically recorded in a number of different ways: a frequency distribution chart; a graphical representation of the frequency distribution; the average and range (bar X and R values) may be determined over an extended period of time; or a fractional deviation chart may be prepared.

Thus as an example, a comparison of 5 lots of a latch bar—the measurable characteristic being the cut length—measured with a dial indicator would probably result in this analysis:

1. Based on the frequency distribution chart as illustrated in Fig. 10 and the graphically illustrated frequency distribution (Fig. 11) the first lot has approximately 32 percent of its values out of control. The tool set-up may have changed or possibly there was a faulty measurement. In either case, a decision of acceptance would be based upon 100 percent inspection on the basis of "Go or No Go."

2. The second lot is acceptable for shipment, however, the spread is quite wide.

3. Lots 3, 4 and 5, although acceptable both from the standpoint of being within tolerances, and on the basis of grouping, show an indication of drift toward the lower control range. In this case, on the assumption that these are successive lots, the supplier was notified, the probable cause of drift being a variable tool adjustment, a condition that can be easily rectified.

Conclusion:—In most instances, interest in a statistical quality control program is based upon a realization of immediate return in terms of a monetary savings. This savings manifests itself in several ways: 1. Reduced inspection costs by reducing the man-hours for inspection purposes. 2. Reduction in scrap during manufacturing. 3. Reduction to a minimum of re-work in salvage operations. 4. Elimination of needless man-hours spent to complete component parts which upon final inspection procedure would be rejectable.

Thus, W. Hitt[5] stated an example where monetary savings were immediately realized in the 100 percent Zyglo inspection of incoming cast components. In a 60 day period, 21,413 items were inspected, of which 1,413 items were returnable to the vendor as rejectable. This not only meant a savings of $5,846.22, but in addition saved costly production man-hours on castings that would normally be rejected later.

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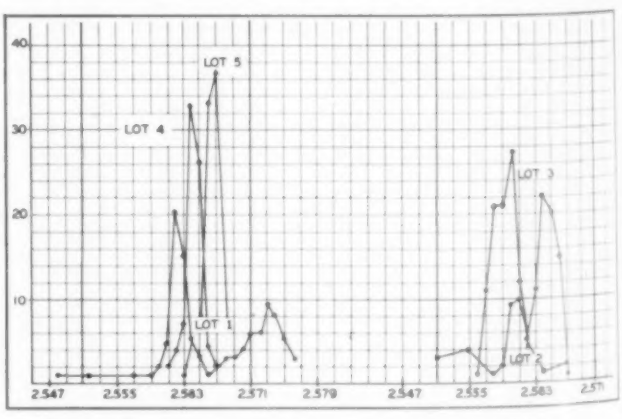


Fig. 11. Frequency polygon charts for latch bar investigation.

By Gilbert P. Muir

How to Control Dimensions in Liquid Nitrogen Shrink-Fitting

Liquid nitrogen as an agent in shrink-fitting assemblies has achieved considerable recognition in recent months. By immersing the part in liquid nitrogen at a temperature of minus 320 deg F, sufficient contraction is obtained for a pressure-tight fit between such sections as a cylinder and its liner.

However, in a recent application submitted to the Tonawanda, N. Y., laboratory of The Linde Air Products Co. a pressure-tight fit between a compressor cylinder and a Ni-Resist liner was hampered by inability to control the shrinkage of the liner in liquid nitrogen. At liquid nitrogen temperature the 5 in. OD liner should shrink approximately 0.010 in., so the ID of the cylinder and the OD of the liner were machined for an interference of 0.005 in. The end of the liner and the top of the cylinder bore were beveled for easy starting, but the liner would not enter the bore.

The cylinder was heated to 800 deg F and, with the liner at liquid nitrogen temperature, a fit was again attempted. The liner still would not enter the bore, and measurements taken of the cold liner and the hot cylinder showed the liner only 0.003 in. smaller than the bore. When the liner was warmed to room temperature, its OD was considerably larger than the cylinder bore. Finally the OD of the liner was re-machined for about 0.010 in. interference, and with the liner at -320 deg F and the cylinder at 800 deg F, the liner was slipped into place.

Since a record of the dimensional changes was not kept on this job, another test was run using a Ni-Resist liner 5⅛ in. OD x ⅜ in. wall, 13 in. long. The liner was machined on the OD and measured at two spots, top and middle, and was immersed in the liquid nitrogen. When the OD stopped changing, in about 15 minutes, the two points were again measured, and it was found that instead of shrinking, the liner had increased in diameter about 0.004 in. and was in addition 0.005 in. out of round in the middle. After warming to room temperature, the diameter increased about 0.012 in., which is the expected shrink when the process is reversed. A total of 0.016 in. permanent growth had taken place, and the part was out of round as well.

The OD of the liner was trued up, and this time measurements were taken at three places, the middle and both ends. The liner was immersed in the liquid nitrogen, shrunk 0.012-0.013 in. in diameter, and when warmed to room temperature returned to the original dimensions.

The tests indicate that optimum results are obtained when the centrifugally-cast, rough-machined Ni-Resist liners are pre-cold treated in liquid nitrogen to allow full growth of the alloy, then followed by machining to the desired OD. When the cylinder is heated to 200-300 deg F and machined for 0.005-0.006 in. interference, there should be a final clearance of 0.010-0.015 in. between the cylinder and liner when fitting. In addition, this clearance gives the operator a longer period to insert the part, since the liner returns to normal size very quickly after leaving the liquid nitrogen. Tests indicate that with only 0.003-0.004 in. clearance between the OD of the liner and the ID of the cylinder, perfect timing and movement are necessary during the inserting operation to avoid sticking. By providing a taper on the end of the liner and a slight break on the top corner of the cylinder, insertion is facilitated.

It is recommended that for pressure-tight fits there be no longitudinal or spiral tool marks on either the outside of the liner or the inside of the cylinder, since such markings may cause leaks. For ease in gripping during insertion, Linde suggests an allowance of two or three inches extra in the length of the liner.

Principal advantages of shrink-fitting over ordinary press-fitting are the greater allowances possible with the nitrogen shrink-fit, and the fact that press-fits tend to cause longitudinal scratches on the work, with resultant leakage. As an example, a tight-force fit on a 5 in. diameter liner, according to ASA standards would be 0.0013 in., and a medium-force fit on the same liner would be 0.0025 in. interference. The total shrinkage on a 5 in. diameter Ni-Resist liner immersed in liquid nitrogen is approximately 0.013, so with 0.005-0.006 in. interference the liner will clear the ID of the cylinder by 0.008-0.007 in., without heating. Steel cylinders will expand almost 0.001 in. per inch of diameter when heated from room temperature to 200 deg F, and a full 0.002 in. per in. of diameter at 400 deg F. Thus if a cylinder is 5 in. in diameter, heating to 400 deg F will give 0.010 in. more clearance for inserting the shrunk liner. The interference can be increased to 0.010-0.015, and the greater the interference, the tighter the fit. There is no practical limit at one inch. It is possible to cold flow or even crack the outer member if excess initial interference is used. It would not be advisable to exceed intereference of 0.010 in./in.

Data plotted by the Linde Tonawanda laboratory are shown in Fig. 1, giving the liner change in inches per inches, or the equivalent of inches per inch of diameter for various metals. These data cover shrinkage from 25 deg C to 240 deg C (77 to 464 deg F), and expansion from 25 deg C to -200 deg C (77 to -310 deg F).

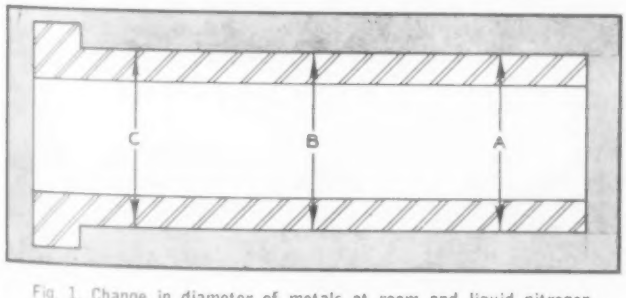


Fig. 1. Change in diameter of metals at room and liquid nitrogen temperatures.

FIRST TEST

	At Room Temperature	At Liquid N2 Temp.	At Room Temperature
A[1]	5.0995	5.113-5.113	5.124-5.125
B[1]	5.099	5.108-5.113	5.121-5.125

SECOND TEST, AFTER MACHINING

A[1]	5.103	5.090	5.103
B[1]	5.103	5.091	5.103
C[1]	5.102	5.090	5.102

[1]Location of measurement on liner, as indicated in drawing above.

By R. T. Gillette
WORKS LABORATORY, GENERAL ELECTRIC CO.

Tools, Jigs, and Fixtures for Resistance Welding

THE TOOLS, JIGS AND fixtures, used for resistance welding, like those used on machine tools such as punch presses, milling machines, drill presses, lathes, and special purpose machines, are used to position two or more parts in the correct relation to each other in the welding machine. Except for this, they differ quite widely due primarily to characteristics of the electrical system of resistance-welding machines.

The function is primarily the same but the material, method of construction, and installation are quite different because of the necessity of insulating various parts of the fixture and limiting or excluding the use of magnetic materials in proximity to the electrical circuit of the welder.

The schematic outline of a typical spot-welding press in Fig. 1 shows the contour of the secondary electrical circuit and the so-called "throat" of the welder with its mechanical means of bringing the welding electrodes or welding points together and applying pressure or electrode force. These functions, as well as the function of applying electrical energy as current, can all be present and accurately controlled.

While the physical arrangement of the various parts of a welding machine may take many forms (usually following quite closely to machine tool design), basically they are the same for the various forms of resistance welding (spot, projection, seam, or butt) and are assembled into a device for applying current to generate heat and pressure which forges the material together and completes the weld.

In all cases the area enclosed by the throat (See Fig. 1) should be kept as small as possible to keep the reactance loss in the secondary electrical circuit as low as possible. At the same time, it is necessary to maintain a high powerfactor level.

The use of magnetic materials for fixtures is to be discouraged as these materials in the throat area of a welding machine have the same effect as placing more iron in the turns of an induction coil: a tendency to cut down the flow of current. Such parts will also run excessively hot, due to induced currents.

All fixtures or tools which carry current should be of adequate cross-section to carry the required amount of current. Resistance welding is a low-voltage, high-current process and may require from 5000 amperes to well over 100,000 amperes to make a given weld. For the same reason, these parts should be adequately water-cooled as closely as possible to the actual welding surfaces to keep the current-carrying parts cool.

Current-carrying parts should be made with the minimum number of joints as each joint adds resistance where it is not wanted and again cuts down the capacity of the welder and raises the temperature. It has proven of value to silverplate the necessary joints as the contact resistance of silver is much lower than that of copper or the copper alloy usually used for current-carrying members.

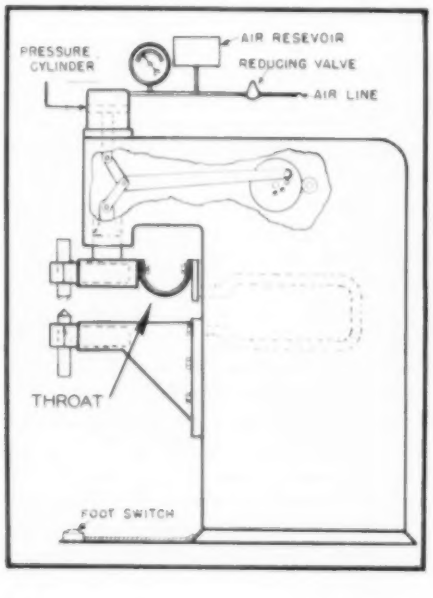
Where it is necessary to have a sliding or moving joint in a fixture which has to carry current, it is good practice to bridge over the joint with a flexible member—preferably of braided copper wire in the form of a strip or shunt.

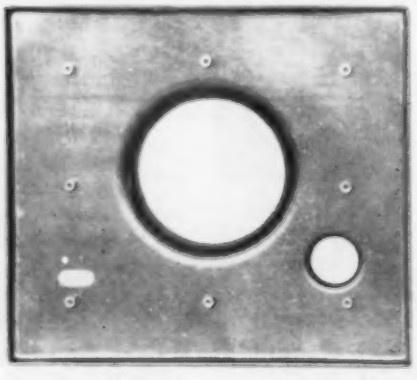
A solid ring or band should not be put around the upper or lower arm of a welder (the upper and lower arm form the throat) as it acts like a short-circuited transformer turn and will run excessively hot. The band should be cut at some point and insulated so that a complete circuit is not formed.

The use of shims to line up poorly-fitted parts is poor practice as they cut down the contact area and make high resistance joints which again will run excessively hot. If it is necessary to use shims, they should be made of deadsoft copper and thoroughly cleaned before installation. Likewise, shims should be of the proper thickness so that only one has to be used; each shim added to a pile adds the resistance of another joint. Nothing takes the place of accurate machining.

Simplicity should be the keynote in the design of welding fixtures. They must also be designed so that the actual electrodes or part of the fixture contacting the work is easily accessible and adjustable for wear and easily removable for replacement.

Safety of the operator should receive major attention; all tools, jigs, and fixtures should be designed with this thought in mind. There are few cases where a fixture cannot be designed so the operator does not have to put his hands where the moving element of the welder may catch them. The use of simple transfer devices and loading tools should always be considered. Air ejection is frequently used to unload small parts as it speeds up the operation and is an added safety precaution. The air is controlled automatically by a





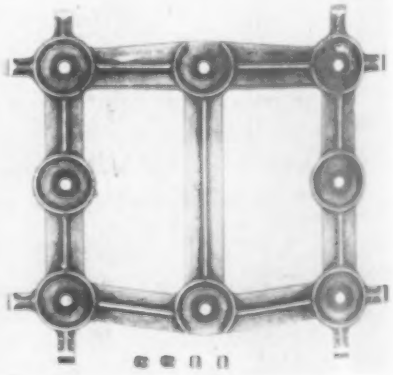


Fig. 1. Outline of a typical spot welding press, showing contour of the secondary electrical circuit as well as welder throat.
Fig. 2. This fixture, with cast aluminum frame and cloth-base plastic insulating bushings, is used to locate eight lugs on the cabinet shown. The fixture is rotated on a small table having two electrodes faced with a ¼ in. disc of RWMA Group B Class 12 alloy.

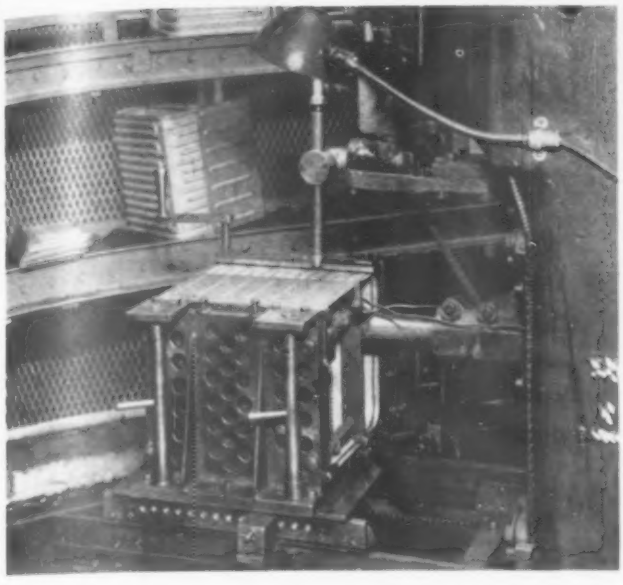


Fig. 3. The fixture above clamps and lines up a stainless steel refrigerator evaporator. Fixture rolls in and out from welder on four wheels on a track, and spaces eight welds. Outside frame is steel, since its distance reduces magnetic effect; inside members are brass. Welder electrodes are RWMA Group A Class 2 alloy.

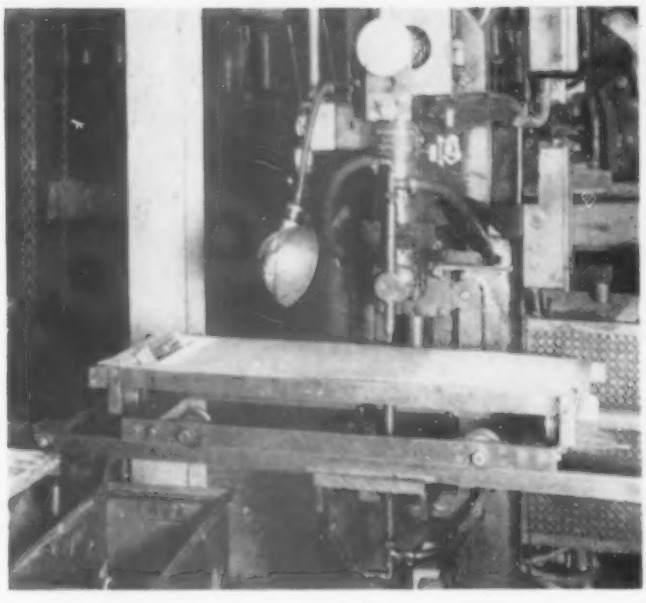


Fig. 4. Jig shown here lines up two sheets of stainless steel so that eight welds can be made between corrugations. Carriage can move in both transverse and longitudinal positions. Carriage frames are made of brass where they pass through throat of welder; electrodes are RWMA Group A Class 2 alloy.

cam or sequencing device operating a solenoid valve. At the proper time a short blast of air blows the part out of the fixture on a ramp so it may slide to a tote box or conveyor.

When parts are clamped with air, mechanical or solenoid operated clamps, the clamping mechanism should be of non-magnetic material, or the intense magnetic field in the welder throat may unclamp them at the instant when clamping is most needed.

Use of the proper material is very important in the construction of resistance welding tools and fixtures. Hard copper may be used for current-carrying parts of various tools used up to the point of actual weld contacting-parts or electrodes. However, it is too soft and anneals too readily for the actual contacting part or electrode which bears on the work at the point where the weld is to be made. A complete list and application chart of electrode materials is available from any of the makers of electrode materials and electrodes or may be obtained from the Resistance Welder Manufacturers Association, Alloy Section, 505 Arch Street, Philadelphia, Pa. The makers of electrode materials will also advise the proper material for a given application.

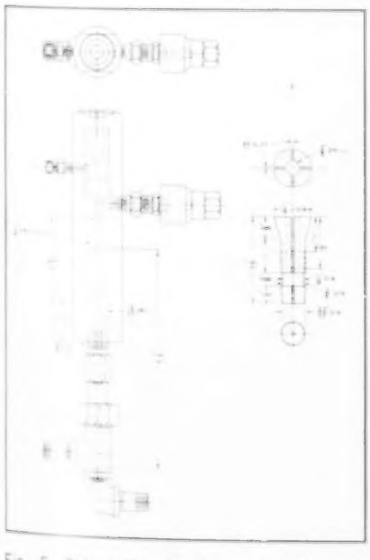


Fig. 5. This collet-chuck-type tool is used in welding threaded studs from 1/8 to 3/8 in. diameter. Electrode holder is copper or RWMA Group A Class 1. Collet is Group A Class 1 or Group B Class 2 insert.

Caution must be used when making tools of hard copper alloy materials as, with the exceptions noted below, these materials receive their hardness through heat treatment or special cold working. Hence, if any heating process (like brazing) is used when fabricating tools from these alloys they lose their special properties and are no better than copper and may not be as good. However, when properly used, their life is many times that of copper due to their greater hardness and higher annealing temperatures. R. W. M. A. Group A Class 1, 2, 3, 4, and 5 should not be brazed or used as facings or inserts, but should form the entire body.

R. W. M. A. Group B Class 10, 11, 12, and 13 materials may be used as inserts or facings and may be brazed with no sacrifice of their properties. In making simple locating jigs, or fixtures on spot, projection, or seam welders tooled with simple standard electrodes, one of the cloth-base plastics may be used to advantage in making the entire fixture. It is light in weight for operator handling, has no magnetic effect, is made completely of insulating material.

In handling large jobs, a table with ball casters set just above the surface makes a satisfactory device for positioning the work. The top of this table is placed flush with the top of the lower electrode.

The following examples of successful tooling may be of value in the design of tools for similar jobs or to provide ideas for others. The use of air, hydraulic, and solenoid-operated devices is quite common.

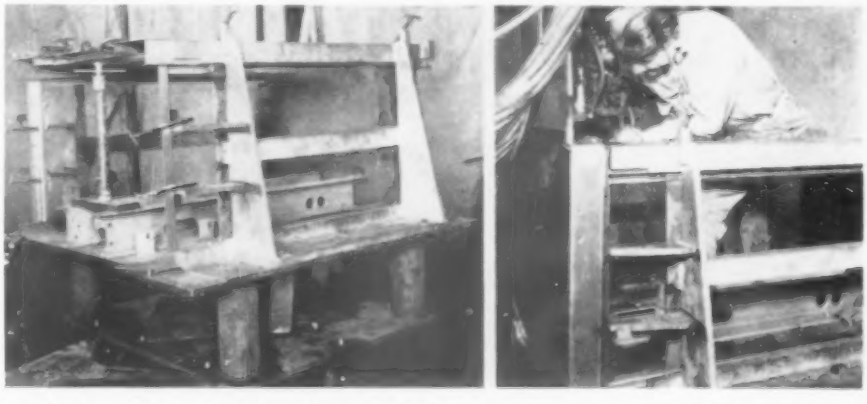


Fig. 6. Assembling and welding cabinets and housings are done with this jig. Parts are lined up and clamped; welding is performed with portable spot welders.

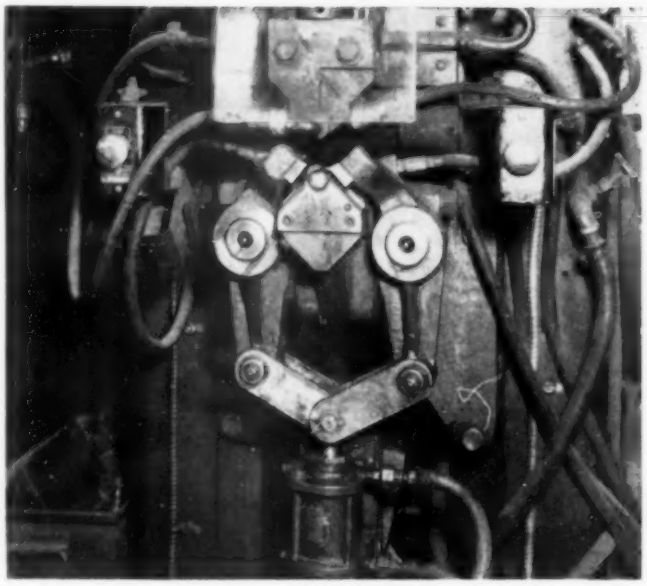


Fig. 7. Fixture above is used in mash-welding a thin strip of steel to close the corners of a folded box.

A fixture having cast aluminum frame with cloth-base plastic insulating bushings is shown in Fig. 2. This is used to locate the eight lugs which are projection welded in the cabinet cover as shown.

The box type fixture shown in Fig. 3 clamps and "lines up" square a stainless steel refrigerator evaporator. A leg is spot welded to the body, the part is then reversed in the fixture, and a shelf is welded to the opposite side.

The jig shown in Fig. 4 lines up two sheets of stainless steel in the proper position so that light rows of spot welds may be made between the corrugations. Transverse alignment is held by a locking index on the right end; the sheets to be welded are held in position by small holes in their opposite corners which fit over pins in the upper frame.

A collet-chuck type of tool as shown in Fig. 5 has been used quite successfully for welding threaded studs ranging from $\frac{1}{8}$ in. to $\frac{3}{8}$ in. in diameter, to various sheet metal structures varying in thickness from about 0.015 in. to 0.187 in. When welding threaded studs it is necessary to clamp the stud tightly to give good electrical contact on the threads. If this is not done, the threads will be burned to a point where they will require rethreading. This special tool is used as a lower electrode assembly and the welding pressure closes the collet; when pressure is released the collet opens. An air-releasing device is provided as shown which may be used to release the collet if it tends to stick. The screw prevents the collet from being blown completely out of the holder.

Fig. 8. Above is an eight-station, dial-feed projection welding setup. Each station has cam-operated clamping devices.

Similar collets should be drilled for the particular size stud used and drilled just deep enough so that about 0.050 in. of the stud protrudes from the collet for welding.

A jig for assembling and spot welding various cabinets and housings is shown in Fig. 6. The parts are lined up and clamped in the jig and the spot welding done with the so-called "gun" or portable spot welder. This jig is fabricated from steel, as the jig does not enter the throat of the welder.

A fixture used to mash-weld a thin strip of steel to close up the corners of a folded box cover is illustrated in Fig. 7.

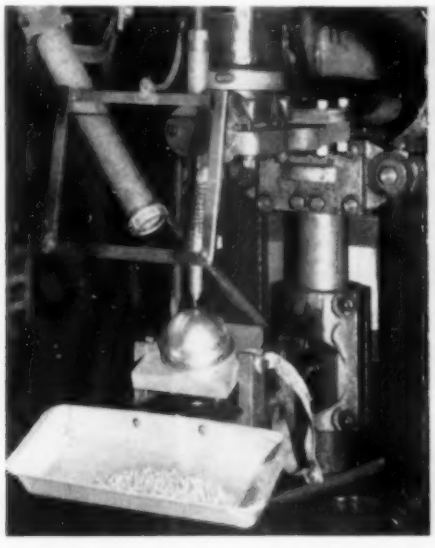


Fig. 9. Problem above was projection welding a taper-head pin into a hole used as vent while copper brazing thin steel float. Float was set in a trunnion-mounted block of hard copper bridged with flexible shunt. Pin was inserted in hole, float was set in block and turned to position under upper electrode as indicated by pin-point of light at left. Projector is made of photo-electric cell containing transformer and Mazda 64 double-contact lamp, mounted in outlet box. Piece of 1 in. std. pipe with 1½ in. cap and reducer is connected to light source. A 235 mm focal length lens, 1½ in. diameter, is mounted in cap. Pipe length of 36 in. gives light spot 0.025 in. diameter; 12 in. length gives spot 0.040 in. diam.

Fig. 10 (center) illustrates fixture used in projection welding silver or steel- or Monel-backed contacts to various mounts or springs. Two-hand welder release insures operator safety.

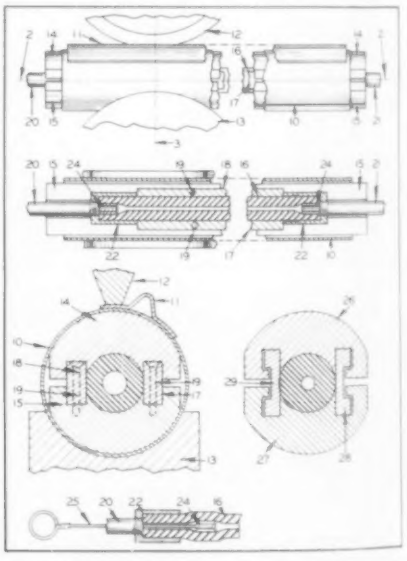


Fig. 11 (right) features hydraulic operation, was used to weld drip strip (11) on tube (10). Thin wall of tube made support necessary; hydraulic mandrel was solution. Parts 14, 15, 17, 18 are hard copper machined to fit; part 16 is soft rubber tube held in place by expander (24) pulled in position by rod (25), which is then removed. Connection (22) and tube (20) are held by recesses in parts 14 and 15. Keys 17 and 18 are held rigidly to part 15 but are free to float in part 14 during operation. Mandrel slides into tube, pressure of 800-100 psi is applied. Strip is then welded to tube in two passes between seam welding wheels 12 and 13. Modification shown may be used to weld a lap seam tube where keys 28 and 29 limit travel of mandrel body 26 and 27. Many modifications have proved satisfactory.

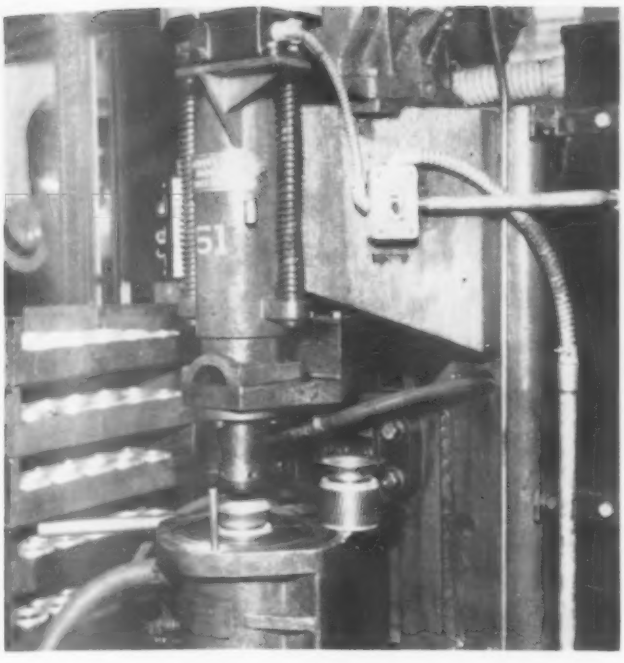


Fig. 12. Fixture above was designed to projection-weld a baffle to motor rotor. Consistent welding was not possible when current was passed through entire rotor, so upper 1/8 in. of laminations was clamped and current carried through from there, facilitated by an air, draw-in collet-chuck-type fixture, undercut so that jaws clamped upper 1/8 in. only.

The cover is placed over the lower arm and the air-operated clamps hold it in place while the strip is welded. The electrodes are faced with Group B Class 12 alloy. Note the careful use of water cooling.

A typical eight-station, dial-faced projection welding set-up is shown in Fig. 8. Cam-operated clamping devices operating through the rollers are used on each station. This type of equipment may be tooled for a large variety of jobs where sufficient production warrants the expense. These stations are carefully water-cooled; the electrodes are usually faced with Group B Class 12 alloy.

Projection welding a taper-head pin into a hole used as a vent while copper brazing a thin sheet-steel float presented an interesting problem of locating and welding. (Fig. 9)

To prevent crushing the float, relatively light pressure had to be used. This was accomplished by using an upper electrode with a spring and sliding member electrode, bridged with a flexible shunt. This electrode is a standard device made by all the electrode makers.

When projection welding straight silver or steel or monel-backed silver contacts to various types of mounts or springs made from materials such as brass, steel, phospor bronze, beryllium or copper, fixtures like the one shown in Fig. 10 or several modifications of this fixture are used . The one illustrated has a divided brass tray holding the two parts. The operator first pushes a contact down an incline into a nest in the lower electrode. Then, with the other hand, he pushes the mount into the locator. The welder is then tripped with hands on push buttons shown at extreme right and left.

A different arrangement of this fixture provides a small swinging member upon which the contact is placed and swung under the upper electrode. The upper electrode has a small hole drilled in the center, connecting with the tube and rubber hose shown on the left side. This is connected to a vacuum system or a simple air injector, which picks up and holds the contact to the upper electrode while the mount is located on the lower electrode. The welder then functions in the regular way; after welding the workpiece is blown from its position with a short blast of air. There are many modifications of this type of fixture to fit particular jobs. The electrodes are usually faced with Group B Class 12 or in special cases Class 13 alloy.

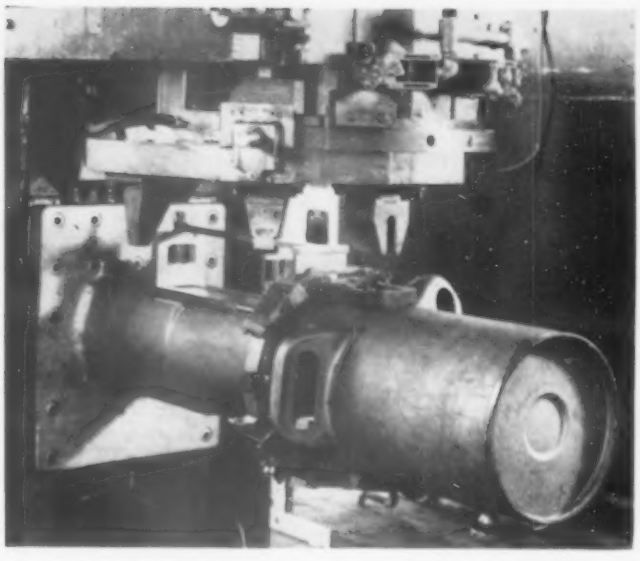


Fig. 13. Three types of lifting lugs, hanger brackets and cover fasteners for transformer tank were welded with one handling on fixture shown above. Electrode inside tank is common for all accessories, three types of electrodes are mounted on rotating turret for outside parts. As electrode is rotated into position, one of three limit switches (shown above head) is closed, giving proper current level and timing through phase heat regulators and separate timers. Fixture is of copper alloy castings with Group A Class 2 electrodes.

Hydraulically-operated devices are sometimes used to advantage as welding fixtures. A fixture of this type is pictured in Fig. 11. It was necessary to seam-weld a drip strip (11) on a tube (10). Since the tube was 2 in. diameter and 16 ft. long, the thin wall of the tube made it necessary to support the tube internally to prevent crushing during welding. If a solid mandrel was used a slight shrinkage of the tube during welding locked the tube so tight to the mandrel that it could not be removed. The final solution was the use of a hydraulic mandrel.

It was necessary to projection-weld a baffle to a motor rotor shown with the fixture used in Fig. 12. Due to erratic resistance, consistent welding was not possible when current was passed through the entire rotor. The collet jaws were of hard copper faced with Group B Class 12 alloy. The body of the fixture was a copper alloy casting.

The projection welding of three types of lifting lugs, hanger brackets, and cover fasteners to a transformer tank was done on a special turret-head welder with one handling. The electrode inside the tank is common for all accessories and three types of electrodes are mounted on the rotating turret for the outside parts. This is shown in Fig. 13.

Fixtures for flash and upset butt welding generally consist of simple clamping devices fitting the contour of the particular part being welded. However, on some relatively small parts automatic feeding devices are often used.

In some welding applications where production is large enough to warrant, the fixture or jig becomes the predominate member and the welding equipment is an auxiliary. In this case parts are clamped together and the welding is done by the use of the so-called hydraulic gun welder. Special welding equipment has been built with up to about 200 of these guns on one welding device. There are several different electrical systems used on this type of equipment.

When it is realized that resistance welding is used on jobs as small as fastening the precious metal overlay on the tip of a fountain pen nib and as large as the fabrication of a complete railroad car, it will be seen that tooling for welding becomes an interesting problem. Advantage should be taken of all the available information on the subject including the theory behind the use of special materials and alloys, or a poorly designed and built tool constructed from a material not suited to the job may destroy an otherwise satisfactory welding application.

Dies for Home Freezer-Lid Panels

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FOR THE PRODUCTION of lid panels for home freezers, the manufacturing sequence described here was the result of collaboration between Nash-Kelvinator and Hancock Tool and Die. The panel, of 20 gage cold-rolled deep-draw stock, was produced in five operations after shearing to size, using a draw compound applied to the outer edges of the square sheared stock. Of prime interest is the cam flange die, shown photographically in Fig. 1, and in diagrammatic form in Figs. 2 and 3. An influencing factor in die design was the low shut height of available presses; whereas conventional design would have required approximately 24 in. shut height, the dies described require 16 in. Production sequence follows:

First Operation: Shear Stock to Size

Second Operation: Draw

The draw die was designed to draw the panel only partly,

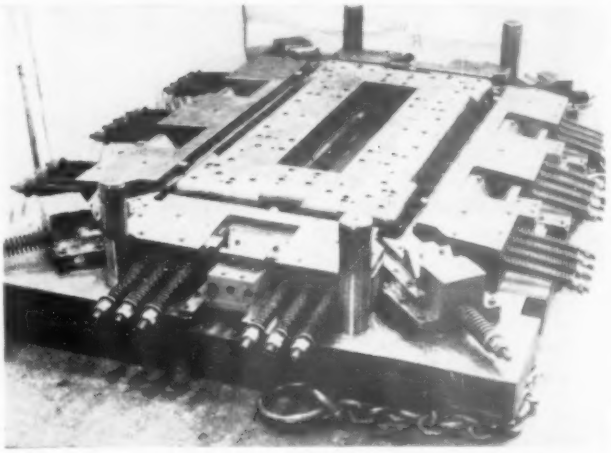


Fig. 1. Above is a view of the cam flange die used to form under the flanges on the freezer lid panel.

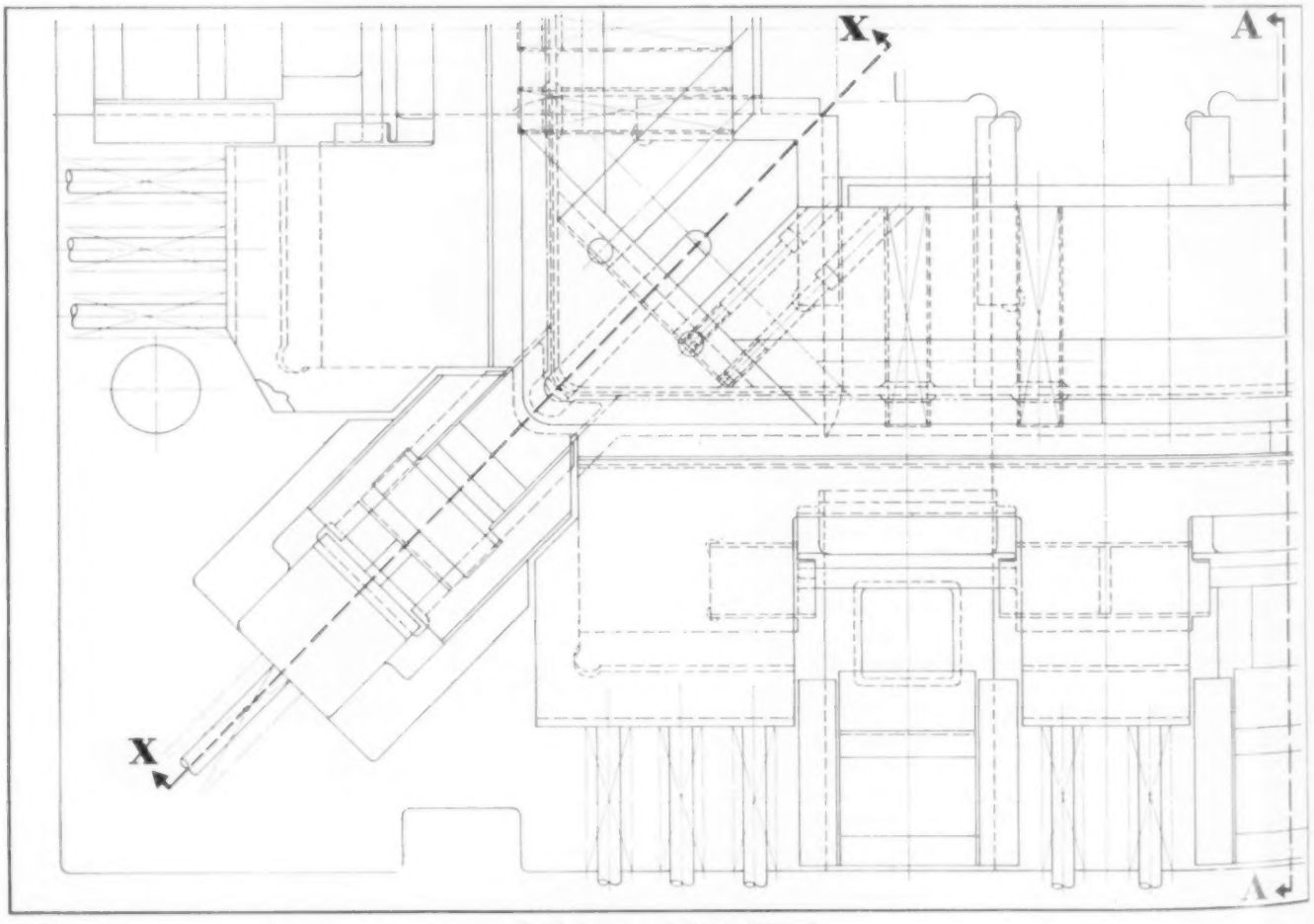


Fig. 2. A section of the cam flange die.

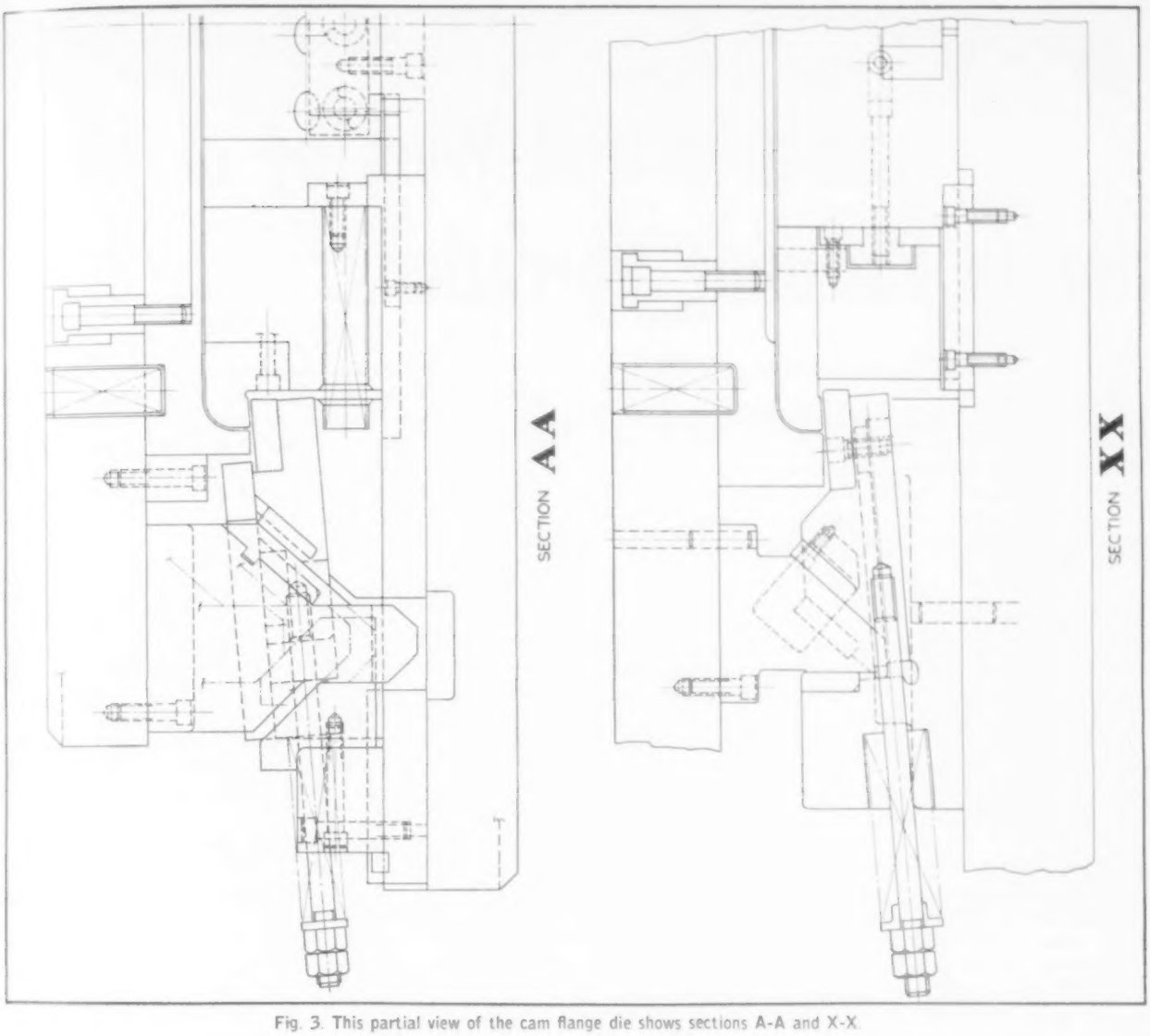


Fig. 3. This partial view of the cam flange die shows sections A-A and X-X.

leaving a binder flange which is later developed, pierced and trimmed. The arrangement eliminates a cam trim and pierce die.

Of conventional type, the draw die uses air on the Meehanite draw pad. Draw ring is also Meehanite with No. 21 Ampco bronze inserts on the corners to prevent scoring. Draw beads are used on two sides of the die. The panel has a ¼ in. crown to prevent a dishpan effect.

A 250-ton Clearing press is utilized for the drawing operation, using two operators, and production is approximately 120 pieces per hour.

Third Operation: Trim and Pierce

All corners and flanges are trimmed and holes are pierced in this operation. Interchangeable punches and end retainers are used in the die. Upper trim steels are composite sections; panel is stripped by spring-activated stripper.

This die is run with the redraw and restrike operation, and the cam pierce sequence, in a 300-ton Bliss press at an average of 120 pieces per hour. Three operators are required.

Fourth Operation: Redraw and Restrike

The part is loaded into this die in reverse to that in the draw operation. Flanges are redrawn, and at the bottom of the stroke the pan is restruck. Bottom pad of the die is on air. Hardened draw inserts line the inside of the cast iron die shoe. Meehanite castings are used for the punch and pad.

Fifth Operation: Cam Pierce Nine Holes

Holes on the top lid and side flange are cam pierced here. Interchangeable punches, retainers and gages are provided; cam slides are made of carburized hardened machine steel, travel on no. 21 Ampco bronze wear plates. The panel is stripped by spring pad.

Sixth Operation: Cam Flange

The cam flange die shown in the drawings features an intricate method of timing of its outer movable cam slides with relation to its inner collapsible sections. The part is loaded, flanges down, with a spring pad traveling ahead of any action. Six side and end cam drivers and four corner cam drivers arrive simultaneously, pulling all the center collapsible sections outward. The cam drivers dwell while the outer cam slide flange sections continue their forward movement, thus forming the four flanges under at one stroke of the press.

On the upstroke, the outer cam slides move outward as the inner collapsible sections recede into the center of the die via 2 in. diameter springs. This permits the part to be unloaded. The cam slides travel on a 5 deg upward inclined angle to allow for suitable springback. Movable machine steel slides travel on nickel iron and cast iron surfaces.

The cam flange die requires two operators, and is run on a 150-ton Hamilton press at a rate of 120 pieces per hour.

By Edward Engel

CONSULTING ENGINEER, COLONIAL ALLOYS COMPANY

Selection and Working of Metals Prior to Finishing Operations

I. Machining Operations

THE WRONG ALLOY or faulty surface conditions caused by incorrect metal working or heat-treatment methods cannot be corrected by plating or anodizing. To obtain the greatest production and the required surface smoothness in metal machining operations, certain factors must be understood. The following paragraphs, numbered (1) to (11), outline the principles.

(1) Metal Selection:

Select a metal or alloy with the best machinability, with due consideration to its physical, mechanical and chemical characteristics. Or, to word it in commercial language; the metal or alloy with the lowest final cost, commensurate with its proper functioning, appropriate appearance and surface stability.

The most machinable alloy is the one which permits the fastest removal of stock. Of course, the final surface must be smooth.

In reference to comparative machinability, the higher the rating number, the better the machining qualities. And, the lower the number in the chip-volume column, the easier the removal of chips. Chip removal is also a factor indicative of machinability. Table I lists the above two factors for the machinable alloys which are decoratively finished.

For automatic machining operations the chip-volume number should be about 15, and at most should not exceed 50.

(2) Machine Tool Selection:

After the alloy has been selected, a choice of the metal working machine is in order.

(3) Cutting Tools:

Tools should be made of appropriate material, correctly designed and surface finished. The set-up of the cutting tool or tools, including rake and clearance angles, feed-rate and cutting speed are not arbitrary factors. Other factors being correct, the smoothness and finish of the cutting tool control the final surface smoothness of the work.

Tool Dressing: For the correct wheel dressing of cutting tools, 120 to 220 grit sizes of silicon carbide abrasives are utilized, and 200 to 400 mesh for diamond wheel dressing operations. A 5 microinch surface is a possibility with correct dressing procedures. Honing or machine-lapping improves the surface smoothness.

Dry grinding is preferred in silicon carbide tool-dressing operations. The grinding wheel marks on a cutting tool should be parallel.

Tool Material: Some tool materials, under specific machining conditions, create smoother surfaces and increased production. A small change in either tool material, tool hardness or design may vary production as much as 100 percent.

Ordinary carbon steel tools may be chrome-plated and serve effectively for some cutting operations. For example, chrome-plated carbon steel twist drills may eliminate the necessity of reaming. The thicknesses of the chromium deposits on cutting-tools are from 0.0001 to 0.025 in. The cutting temperature on steel should not exceed 650 deg F, and on zinc and brass 570 deg F, and 660 deg F when operations involve chrome plated cutting tools. A surface finish of 5 microinches may result when chrome-plated tools are used.

Cemented tungsten carbide-tipped cutting tools produce excellent surfaces on most metals. They also offer increased production in many machining operations. Carbide tools require a minimum amount of setting and relapping. This material usually requires higher horsepower than carbon steel or alloy steel cutters, but harder carbide tools or reduced speeds decrease horsepower requirements.

Stellited tools give results between sintered carbide and alloy steels. New high cobalt high speed steel is now heat treated to give better performance than the usual high speed tools.

The electrolyzing process is claimed to prolong the life of cutting-tools, disc gages and wear parts initially and between grinds; hardness is 1800 Vickers at 1400 deg F. Chip welding and galling are said to be virtually eliminated.

Tool Holders: Cutting-tools require proper holding equipment, shanks and posts. (The American Standards Assoc. B52-1943 specifications present shank standards.) The cutting-tools may require cushioned set-ups; carbide tools, due to high speed operations, perform smoother when cushioned. This reduces vibration—which shortens tool life, lowers production rates, and makes smooth surfaces difficult.

(4) Cutting Fluids:

Minimum heat consumption is synonymous with minimum power requirements. The correct lubricant and/or coolant fluid for each metal and operation are the controlling factors. Cutting fluids require more study than machinery lubricants. The metal finisher should be instructed as to the type of cutting fluid used. Samples of such fluids should be studied to learn the most efficient

Table I—Machinability Data

ALLOY	Chip Volume Number	Machinability Rating:	Comparative Machining Quality	Comparative Finishability as to appearance
A1 11ST8, R-317	15	42	Excellent	Fair Anodic appearance
A1 17ST4	25	42	Very Good	Very good anodic appearance
A1 61ST, R361, 63ST6	—	—	Good	Fair to good anodic appearance
A1 24ST-6	25	25	Fair to very good	Fair to good anodic appearance
Free Cutting Brass	20	18	Excellent	Excellent plateability
S. A. E. 1113 Steel	10	—	Good	Excellent plateability
Common Steels	3	—	Poor	Excellent plateability

means for their removal prior to finishing. (Tables II and III.) The removal of coolants after annealing is very difficult in most instances, therefore they must be removed directly after machinery or forming.

Cutting fluids are applied at the highest rates possible without splashing. The fluids should be kept under 110 deg F. Coolant filtration and refrigeration are required in many production operations. Also, in some instances, the chip chute should be lubricated to permit easy removal of chips. Cutting fluids are effective in improving the metal surface smoothness in slow speed operations.

Functions of ingredients of cutting fluids include: sulfonated saponifiable oil for cooling. This also serves to prevent the welding of the metal to the tool.

Chlorine increases the continuity of the cutting oil film and has a coolant effect. It supplants castor oil.

Water is also a coolant.

Mineral oil supplies the necessary strength.

Free-fatty-acids are contained in all animal and vegetable oils. An increase in the free-fatty-acids is indicative of decomposition.

Cutting speeds can be increased about 15 to 18 percent by cooling mineral oil from 180 deg F to 70 deg F, and speeds can be increased by about 10 percent when emulsions are cooled to the most effective range of 75 to 85 deg F.

Settling tanks with centrifugal, magnetic or gravity separators of chips, together with temperature control present the largest tool life and smoothest surfaces.

(5) Chip Load:

See Table IV-A.

(6) Spindle Speed:

Is selected in the same manner (Table IV-A).

(7) Cutting Tool Feed Rate:

In milling operations is calculated by the formula: $IPM = CL \times N \times RPM$; in which IPM is the inches per minute, CL is the chip-load, N equals number of blades in cutter and RPM is the revolutions per minute.

With the feed-rate determined, D the depth of cut, and W the width of cut, both fixed by the job requirement, the HP may then be computed.

(8) HP Requirement:

The K factor, as shown in Table IV-B is used in computing hp requirements. It is noted to show the relative requirements for the different alloys. K factor is the hp required to remove 1 cu in. of metal per minute in milling operations. Thus $HP = D \times W \times IPM \times K \times F$ in which D is depth of cut, W is width of cut, IPM is inches per min., and F feed rate.

(9) Quick Removal of Chips:

This is a factor of importance in obtaining a smooth surface. It is accomplished by air blast or through the lubrication of chips and chip-chutes.

When the chips are long they may scratch the surface of the metal unless they are broken up. A chip breaker is often provided for this purpose.

(10) Type or Shape of Chip:

Largely influences the surface smoothness. As example of the correct type of chips: lathe operations result in smooth

Table II—Cutting Oils

Numbers given in order of Preference (See Table III)

TYPE OF OPERATION	Order of Severity of Operation	NO. OF OIL FOR VARIOUS METALS		
		STEELS	Bronze, Monel Nickel	Aluminum, Brass
Automatic Screw Machine	7	2-3	2-3	2-3
Boring—Multiple Hd.	7	7-2-6	6-2	6 *
Broaching—Internal	1	7-2	2-1	6—Dry
Broaching—Surface	2	7-2	2-1	6—Dry
Drilling	9	6	6	6 *
Drilling Deep	5	2-6	2-3-1	6-1
Gear Cutting	4	2-3	2-3-1	———
Gear Shaving	4	2-1	2	———
Grinding	—	5-6	5-6	5-6
Milling—Plain	6	6-2-3	6-2-3	6—Dry
Milling Multiple Cutting	6	6-2-3	6-2-3	6—Dry
Milling Port (Fitchburg)	6	3	——	———
Planing—Shaping	9	6-1-2	6	6
Punch Presses	2	4-1	——	———
Reaming—Plain	4	1-7	2-1	2-6 *
Circular or Hack Sawing	10	6-2	6-2	6
Tapping—Plain	2	7-4	2-1	2-6 *
Threading—Pipe	2	2-7	2	2-6
Threading Plain	3	2	2	2-6
Turret Lathes	3	6-2-3	2-3	6-1—Dry

*In machining aluminum a mixture of two parts number 2 oil and 1 part kerosene. If any sulfurized oil is used on aluminum or brass it must be quickly removed to prevent staining.

Table III—Contents of Cutting Oils (%) Referred to in Table II

NATURE OF OIL	***** No. 1 Oil	***** No. 2	*** No. 3	No. 4	** No. 5	No. 6	***** No. 7
Mineral oil	75-89	80 Min.	98	58 Min.	55-65	*	85-88
Lard oil	11-25	20-Max.	——	34 Min.	——	*	——
Sulphur	——	0.75	——	7.5	——	*	3-4
Sulfurized fatty oils	——	——	2	——	——	*	9-11
Soap	——	——	——	——	35-45	*	——
Chlorine	——	——	——	——	——	*	1
Free fatty acids	2.4 Max.	——	——	——	——	*	——
Viscosity—100°F	115-155 sec.	150 sec.	140 sec.	180 sec.	1825 sec.	Varying	200-250 sec.
Color	Pale Red	Dark-brown	Dark	Dark	Amber	Amber	Dark

*No. 6 Basically a mineral oil compounded with sulphonated oils: Contains no resin or alcohol. Ash 1.25-2.5 percent, alkali 0.5-1.5 percent. Rust preventive 1 part to 80 parts of water.
**No. 5 Ash—5 percent, alkali 2 percent. No. 5 or No. 6 requires soft water in varying portions.
***No. 3 Performs similar to No. 1, but it is more transparent.
****Nos. 1, 2, 7 Add ½ pt of phenolic germicide per drum.
*****Nos. 5 and 6 Add ½ pt of phenolic germicide per 50 gallons oil and water.
A 100-second mineral oil blends with kerosene. Minimum flash of mineral oil 265 deg F.

Table IV-A—Machining Data

METAL OR WORK	SFPM	CHIP LOADS
Cast Iron	300-450	0.005-0.030 in.
Brass and Bronze	400-800	0.005-0.040 in.
Light Alloys	Highest Possible	0.010-0.040 in.
Steel	350-700 depends on hardness	0.005-0.030 in.

Lowest figures require softest grades of carbide.

chips with saw edges when machining certain aluminum alloys, and smooth and long chips with brass and copper.

(11) Vibration:

Following the selection of the ten foregoing factors, the machine tool, drive, cutting tool holders, etc. are checked for excessive vibration. Smooth surface cannot be obtained unless the operation is in static and dynamic balance.

Aluminum: In the high speed machining of 17ST and 11ST alloys, in some instances neithe: oil nor carbide cutting tools are necessarily advantageous, i.e. carbide tools may not carry the heat away quickly enough. Also, the tool may be shattered. In slower operations and in many high speed operations, however, a hard grade of tungsten carbide and soluble oil coolant perform excellently.

In addition to the above named alloys, 24ST is used for aircraft parts, and 61ST for machined tube, rod and bars. For decorative anodizing, certain of the above alloys present more uniform or more lustrous appearances than others. In their order of decreasing lustre after "Chemical-Polishing" and anodizing, the alloys are as follows: 17ST4, 61ST6, 11ST-8, 24ST80, 24ST36, 24ST24, 61ST4, and 11ST3.

The tool designs and setups for aluminum differ entirely from that of any other metal.

Brasses: Ductile metals like aluminum and brass require different tool designs and setups and less ductile metals like steel. Brass requires more cooling effect than lubrication; hence sulphonated oil gives good results. This oil must be removed quickly, however, to avoid staining the metal.

The leaded brass, used for its free-cutting properties in screw machine work, offers slightly more plating difficulties than high brass.

Steel: The machinable steels like SAE 1113 are used for machine screw products. Such alloys cost appreciably less than the free-cutting aluminum alloys or leaded brass, however, the final product may not be much lower in price. The cost factor differential is largely made up by the greater ease of machining aluminum and brass.

The machine screw products of steel, finish and plate with nearly equal facility as sheet steel used for deep drawing.

Zinc Die Castings: Carbide tools are very efficient for both aluminum and zinc die castings. Although alloy steel tools give smooth surfaces, carbide pret nts superior smoothness and closer tolerances.

For zinc, cutting fluids are seldom required in drilling operations, except for deep holes, in which case soluble oils are used.

In milling zinc alloys, the following types of cutting fluids may be used: mineral oil, soluble oil, or kerosene with up to 90 percent lard oil. No wax or tallow should be used on zinc die castings.

Carbide cutting tools may require large quantities of special coolants. Refrigeration of the coolant improves surface smoothness considerably. Many operations, however, produce better finishes when no coolant is applied. In other cases a mixture of one part soluble oil and 30 parts water with a wetting agent may show advantages.

II. Grinding vs Machining

Grinding removes less stock than machining, but when certain design principles are followed, the limitations are circumvented so that in many instances the grinding wheel becomes a formidable competitor of conventional cutting tools. These principles include:

(1) The depth of material to be removed must be kept to a minimum. About 1/16 in. is the maximum for economical stock removal by grinding; cutting-tools in production runs generally remove 3 to 6 times this amount.

(2) Less area should be designed for surfaces which are to be ground.

(3) Surfaces to be ground must be made readily accessible to one of the nine standard shapes of wheels.

Less power and less warpage, together with material savings, may occur. The material savings alone, on aluminum or brass, may pay for the grinding operation.

Centerless grinding of tubing, tubes and rods may be fully automatic, and thus require less skill than machining operations. Centerless grinding may be held to 0.0001 to 0.00025 in.; therefore it may eliminate polishing and buffing operations as well as machining.

In designing aluminum castings, forgings and other items for grinding operations, electrolytic removal may, in some instances, be used as a final metal removal operation. This sequence will remove 0.00001 to 0.001 in. of stock. The stock will be removed from all apparent surfaces as well as minute recesses. Or, selective material removal may be controlled by proper masking and plugging.

Grinding, as discussed above, has wide utilization as a metal removing operation in place of machining. It is, however, primarily for surface refinement of rough machined work and castings. Usually, a coolant liquid is continuously supplied to the surface being ground. Grinding requires surface pressures which may burn the work; other metal removing processes require less pressure.

Snagging is a rough grinding operation on castings. Coated abrasive wheels or resinoid or rubber bonded abrasive wheels are used. The abrasive may be alumina or silicon carbide. Casting stubs, parting-lines, fins, sprues, gates and risers are snagged.

Rough grinding breaks down the as-cast surfaces and is used preparatory to sand-blasting, shot-peening or finer grinding operations. It is usually a dry operation, although tallow or lard oil, if applied with care, may be used. Grease or oil must be removed by heating the casting at 400 to 600 deg F for about one-half hour; except for heat-treatable aluminum castings.

Grinding Wheels and Belts:

Grinding wheel properties which govern the life of the wheel and the metal to be ground include:

(1) Grain Size: the coarser the grain, the greater the

(Continued on page 34)

Table IV-B—K-Factor

AZ	High Si AZ	C.I.	Med. C.I.	Hard C.I.	Mall. Iron	SAE 112 1020 & 1335 Steels	SAE 1025 As Cast and Forging Steel	Steels of 200 to 250 Bhn	Steels of 250 to 300 Bhn	Steels of 300 to 360 Bhn
0.1	0.2	0.3	0.4	0.5	0.5	0.6	0.7	0.8	1.5	1.75

Brass requires about ⅓ more power than free cutting aluminums.

Permanent Tooling for Short Setup Multiple Drilling

By J. I. Karash
PROCESS ENGINEER
RELIANCE ELECTRIC AND ENGINEERING CO.

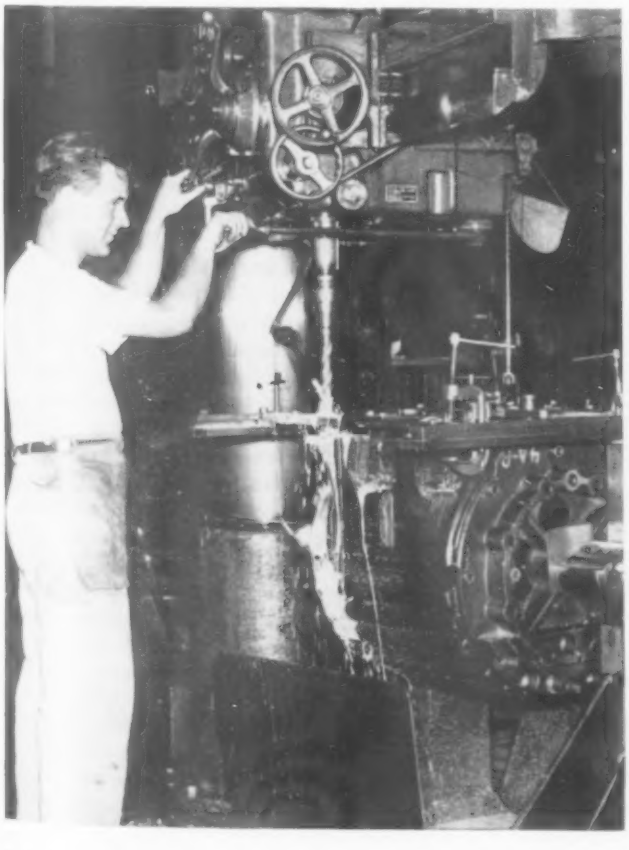
FOREMOST AMONG the objectives of the tool engineer is to produce a required number of acceptable parts, within a required length of time, at a minimum overall cost. One of the most common basic errors in tooling judgment lies in the lack of careful discrimination between "shop lots" and "ultimate parts."

For any given ultimate number of parts, widely varying methods are required, depending upon whether the job requires that a large number of small shop lots be run, each requiring a tooling setup. Since each shot lot requires a complete setup, it is reasonable to consider production of the ultimate parts on the first setup, and thus save the cost of the additional setups and the incidental work required to produce the same total number of pieces.

The relative sizes of shop lots and ultimate quantities are ordinarily dependent on the following factors: stability of product; value of the part; cost of setup; average daily use; time required for replacement; available space for storage of finished part.

Stability of product. A product considered unstable because of possible design change or business conditions is most favorable to small lots.

Value of piece. If the part has considerable value, the running of the ultimate quantity may cause an unwarranted amount of capital to be tied up in frozen assets. Again, if the part cost is small this might well justify large shop lots or even the running of the ultimate quantity.



Setup cost. If the cost of the setup is unavoidably high in relation to other factors, it may be necessary to resort to large shop lots to absorb costs. This factor is of proportionately less importance, of course, as setup cost decreases.

Average daily use. High daily use factor necessitates large shop lots or even continuous-setup production.

Time required for replacement. Should the part require considerable time for replacement due to seasonal or operational complexity, appreciable stock and larger shop lots are necessary.

Available space for storage. Value of space and incidental labor are a factor in any weighing of shop lot versus ultimate production.

Quality, Time for Production

No part should be made better than the situation requires. Basic economy cannot tolerate this if excessive quality results in increased cost. "The required length of time" is naturally an important factor in determining production method, since urgency is incomparable between a part which must be turned out today and one for which a year is available.

Minimum Overall Cost

The overall cost of the part should be all-inclusive, and should reflect a comparison of costs by alternative methods.

Fig. 1 (left) illustrates the original trunnion fixture for drilling feet and rim holes on motor frames. In Fig. 2 (below) is the tooling developed for simultaneous drilling of feet and rim.

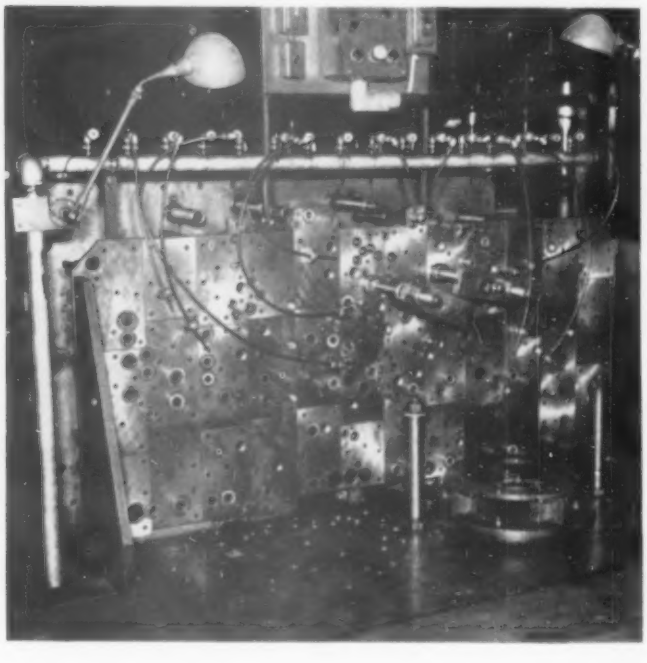


Fig. 3. Shown here in close-up are removable button locators and coolant tube holding magnets.

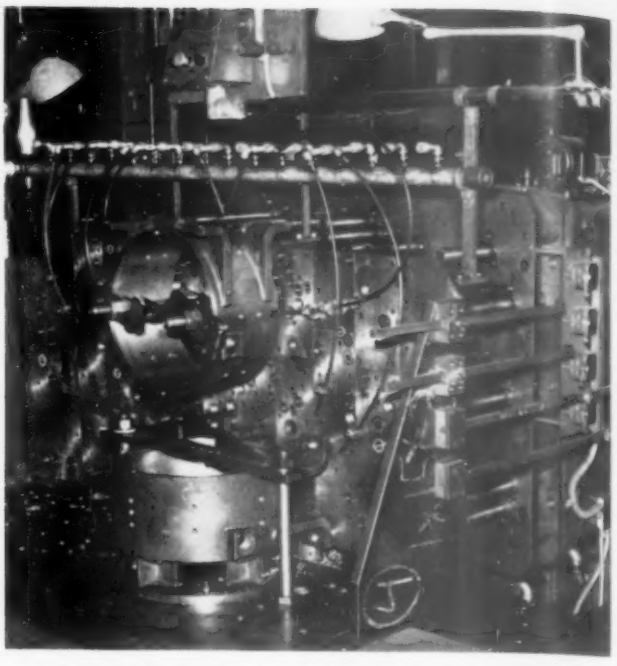


Fig. 4. Simultaneous drilling of rims and feet of motor frames. At side of machine are shown regulating controls.

To illustrate the above points in practice, the problem described here is one in which the original tooling was due for replacement. Fig. 1 shows the original tooling, used in the drilling of feet and rim holes of large motor frames. The part is assembled with so-called cheek plates and the rim holes are drilled, by standing the cheeks on end. The drill bushings are in the cheek plate. When one end is drilled, the assembly is turned over with an overhead crane and the other end is drilled. Finally the entire assembly is lifted and placed in the trunnions shown in the photograph, and another jig is mounted above the trunnion to drill the foot holes in the part.

Replacement of these fixtures required a change in design due to the high cost of replacement, and therefore duplicate tooling would not provide an economic advancement with regard to cost reduction of the product.

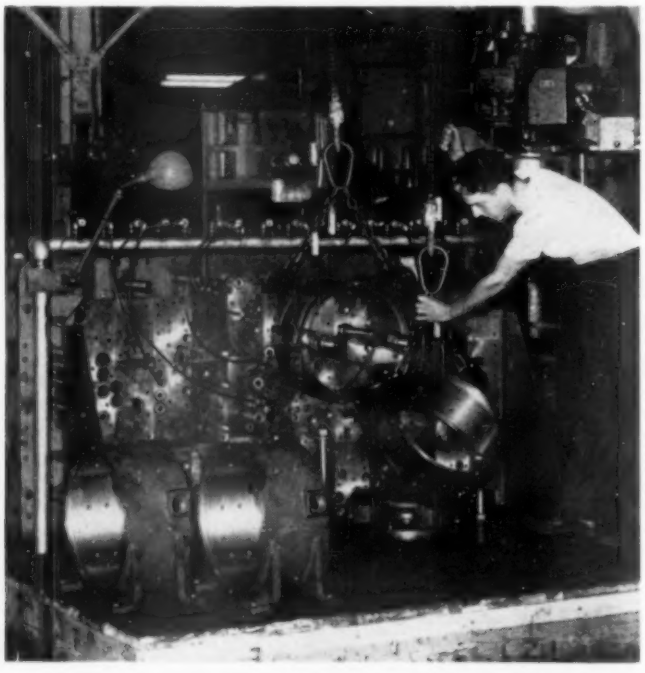


Fig. 5. Crane facilities are an integral part of the tooling; here they are utilized for drilling two parts simultaneously.

The machine developed to replace the old tooling is shown in Fig. 2. It is a fixed spindle horizontal drilling machine with the following features: fixed spindles, button locators, simultaneous drilling of rims and feet, coolant-tube holding magnets, and complete crane facilities.

There are ninety-eight permanently-fixed spindles on the machine, arranged in various patterns to cover a large variety of work. The drill layout will accommodate a considerable range of parts.

The drill bushings are aligned with the spindles, and the only setup required so far as the spindle is concerned is to slip the proper-sized drill into the spindle. All spindles have conventional drill-holding sleeves which can be preset for length. Hard liners hold the drill bushings for ease of fit. Each liner can accommodate a variety of drill-sized bushings. Spacing of the drills is arranged so that one spindle may be utilized in a number of different groups.

Crane Facilities Essential

Fig. 3 illustrates the removable button locators used to locate the work to the jig. Two of the four locators are seen inside the part. Simultaneous drilling of the rim and feet is shown in Fig. 4, with two parts secured to the fixture ready for drilling. The upper (rim) part is reversed to drill the opposite rim as part of the operation. The controls used for regulation of the feed, rapid traverse and return cycle are shown on the side of the machine.

Coolant tubes, made of flexible plastic, are moved quickly to any location, and attachment is facilitated by the small Alnico magnets attached to the ends of the tubes. Conventional snap outlets are used at the supply ends of the tubes, and when the outlet is removed from the receptacle the coolant is automatically shut off. When the tube is inserted into another receptacle the valve opens.

Crane facilities are an integral part of the setup, and as shown in Fig. 5 one jib crane clears the other, allowing simultaneous use of both cranes. The arrangement further allows the chains to remain secured to the work and consequently saves a considerable amount of time.

The various features of this setup are mechanical devices aimed at providing a multiple drilling operation with a minimum setup cost. The nature of the business put additional emphasis on low setup cost to meet the prime problems of short delivery and small inventory.

By D. H. Currie
THE CARBORUNDUM COMPANY

Crush Dressing of Grinding Wheels

CRUSH DRESSING, or literally "rolling the form", is essentially the displacement of abrasive grains from the grinding wheel by rotation of a properly-formed roll under correct speed and pressure. Rolls most commonly used today are of hardened high speed steel of from 3 to 5 in. in diameter, although in certain cases rolls of soft steel and cast iron have performed satisfactorily where high accuracy was not essential.

Crushing Speeds and Feeds

Most vitrified wheels can be crush dressed at speeds ranging from a fraction of one rpm up to grinding speed. At the slower speed there is greater resistance to crushing; at the higher speed the wheel is more readily formed, but there is greater wear on the crusher roll. It has been found that a constant speed of approximately 300 sfpm provides a good crushing action with minimum wear on the roll.

After initial crushing of the wheel a range of a fraction of 0.001 in. to a few thousandths of an inch is required to recondition the wheel. In addition, excessive feed and pressure during the crushing operation may disturb the structure of the wheel below the surface, weakening the sub-structure of the wheel and causing rapid breakdown.

Wheel Selection

Of prime importance in crush dressing of hard wheels is rigid equipment, as was learned shortly after the introduction of the method in this country. Pressures set up by these wheels, which were fairly hard and dense, were excessive for much equipment in use, and even today the softer wheels are somewhat in demand because of this condition.

The many variables in abrasive grinding wheels, including grade, grit size, structure, type of grain, bond type and grit combination result in a wide variation of the ability of wheels to crush readily. A softer wheel of a weak bond will crush more easily than a harder, more dense wheel but the softer wheel will produce considerably less pieces between crushings due to the lack of inherent strength. In addition, the arc of contact between the wheel and the roll, as well as the width and diameter of the wheel have a great deal of influence on the pressure the machine must absorb.

Our experience indicates that an AA2205-K5-V10 is the most universal grading. In some instances it is necessary to choose a coarser grit size, in other cases a finer grit wheel will prove more efficient, depending on the type of form, accuracy and production required.

With crush dressing a sharper wheel face is obtained. The theory that each grain is loosened from its bond posts, leaving a wheel face of individual cutting edges and even porosity is substantiated in the operation of centerless thread grinding. With a crush dressed wheel such materials have been ground as heat treated, soft and hardened screw stock; brass; stainless steel and powdered iron.

Among production records available on centerless thread grinding by the crush dress method, there is one where no. 4-40 screws, $\frac{1}{8}$ in. long, were passing through the machine at a rate of 160 per minute, or 9600 per hour. Another case is a $\frac{5}{8}$-18, $\frac{5}{8}$ in. long screw at 85 per minute or 5100 per hour. It is fairly common on $\frac{1}{4}$-20 and $\frac{5}{8}$-18 screws to produce over 100,000 pieces between dressings. In these illustrations a 220 grit combination wheel was used. The finer pitches require more frequent dressing, since they have a finer root dimension; usually 320 or 400 grit wheels are used.

The overall production on the coarser pitches is reduced in comparison with the finer pitches, possibly due to the power limitation. It has been calculated in one instance on centerless thread grinding that about 90 lb of metal per eight-hour shift is removed, or about one ton in two days on four machines. In this operation (not a precision form) it was found that hard, dense wheels were particularly necessary. Original wheel was N grade, normal structure, followed by O grade and then P, keeping on the dense side of normal structure.

Machine Equipment

All machine equipment should be so designed and constructed to provide maximum efficiency in absorption of crushing pressures. Ernest Flanders of the Jones and Lamson Machine Company, in a paper presented before the ASME at their Oct. 1, 1946 meeting, states:

"We found among other things that the form of the crusher roll was not materially altered as long as good contact was maintained between the roll and the wheel. It might be well to point out at this time that the material used in the rolls was high speed steel with the normal hardness range of 63 to 65. We tried also various pressures on the crusher roll and found that a pressure range of 100 to 150 psi worked best. This is in the neighborhood of 400 to 600 lb total pressure of roll against wheel, this wheel is one inch wide. If more pressure than the above was used, the crushing action proved to be slower and there was a decided tendency for wear to develop on the crusher roll."

Preceding the above, Mr. Flanders says: "Rather than use a fixed infeed we decided to use in its place hydraulic pressure which would allow us to vary the amount of infeed according to the load. In other words, we find that we crush more rapidly in the first two-thirds of the thread depth than we do in the last third, when we have almost the

whole form in contact with the wheel. This gave us also an opportunity to determine just what pressures were best and to vary the load as the need should arise. This equipment was designed to go on one of our standard machines and was mounted directly behind the wheel spindle".

Type of Forms and Limits of Application

In addition to thread grinding, crushed-dressed wheels are successfully used on circular and flat form tools, various decorative forms, serrations and roughing of accurate, intricate forms such as laminating dies. Its use is definitely limited with regard to accuracy and production.

A frequent problem is that of reducing crusher costs. The wear on the roll varies with the type of form and its depth; the depth affects wear more than any other factor. Wear is due to two factors: In the first place the peripheral speed relationship between the crushing roll and the grinding wheel is such that the maximum and minimum diameters of one run with the minimum and maximum diameters respectively of the other. In the second place, the abrasive action caused by this peripheral speed relationship is accentuated by the retention of loose grit between the contacting surfaces.

For example, on a form ¼ in. deep, compare the running of a 4 in. roll and 4 in. wheel with a 30 in. roll and 30 in. wheel, and a surface speed of 300 sfpm as the accepted speed for crushing. Between the maximum and minimum diameters of the smaller roll and wheel there is a speed differential of 147 sfpm, which causes unequal wear on the crushing roll. Comparing the speed differential between the maximum and minimum diameters of the larger roll we find it has been cut down to 9.67 sfpm. This example indicates that the larger wheel and the larger roll would tend to cut down the unequal wear on the roll.

It has been argued that the larger roll would require greater pressure due to the longer arc of contact, but it has yet to be proven just how much more pressure would actually be required. It is quite possible that the larger roll, having a greater wearing surface, would show much longer life.

Of course, the speed differential is aggravated as the form becomes deeper. It should also be remembered that a difference in speed exists during the grinding operations. Certain types of forms influence wheel action when the depth is sufficient to cause a difference in surface speed.

Table I
Minimum Radius Obtainable with Crush Dressed Wheels

Grit Size	Minimum Radius
320 (or finer)	0.003
220 (usually a combination)	0.007
150	0.012
100	1/32

Future Development

It is our opinion that the field for crush dressing is on center type cylindrical grinders for the generation of circular and flat forms. Many form tools of steel have been ground as well as certain types of carbides. Another field which suggests the use of crush dressing includes those forms which normally require a multiplicity of grinding and handling operations. There have been tests on grinding ball races; in this operation we use wheels of 150 and 220 grit, which is much finer than the usual ball race wheel. These tests indicate that the finer grit wheels that have been crush dressed remove stock twice as fast as the coarser grit wheels, and provide a surface texture which is more desirable.

Regarding wheel grading to reduce crusher costs, our present approach is to use a harder and possibly more dense wheel if the machine itself will withstand the added pressure. We have found that within the limits of the machine the hardest and most dense wheel that may be crushed gives a maximum number of pieces between crushings. Although some wheels cannot be crushed to form with accepted procedure because of their hardness and density, there is the possibility that crushing might be successful if there were greater flexibility in crushing equipment.

In general the wheel grades for surface grinding are softer than those used for cylindrical grinding, ordinarily "H" to "J". The grit size will be governed by the smallest radius that must be dressed. Table I shows the smallest radius obtainable from various grit sizes.

From a paper delivered before the Abrasive Cutting Conference, a symposium sponsored by the Headquarters Manufacturing Engineering Department of Westinghouse Electric Corporation, and presented exclusively by **The Tool Engineer**

Selection and Working of Metals Prior to Finishing Operations

(Continued from page 30)

amount of metal removed. Large grains are usually recommended for soft material. Grain sizes are classified as follows: Very coarse 8-10, coarse 12-24, medium 30-60, fine 70-120, very fine 150-240 and flour 280-600 grit. For heavy stock removal 16-30 grit is used, and for light stock removal the operation is with 56-180 grit.

(2) Wheel Structure: The Standard Wheel Marking System presents the classification of grain spacing. Open structure wheels are usually operated on soft material in order to obtain grain penetration.

(3) Wheel Bond: Resinous, rubber and vitrified material are the most used bonding substances in grinding wheels. Vitrified wheels cannot be operated at as high a speed as rubber bonded wheels. The latter may be operated close to 10,000 rpm, and the maximum speed of vitrified wheels is one-third less. In all instances, the rpm of a grinding wheel should be increased in proportion to its reduction in circumference resulting from wear.

(4) The Hardness Grade of abrasives is the major factor in the longevity of a grinding wheel; the structure of the wheel is almost as great a factor. A hard abrasive is required for grinding soft material to produce the lowest production cost. Silicon carbide is usually used for aluminum, brass, chilled-iron, gray iron and unannealed malleable iron. Aluminum oxide abrasives are operated for high tensile strength alloys such as alloy steels, carbon steels, annealed malleable iron and stainless steel.

In addition to the hardness grade and structure of wheels, the life of a wheel is dependent on proper operation. The grinding machine (1) must be in proper balance, (2) the wheel should be operated at close to but not over maximum peripheral speeds, (3) contact of the work with the wheel must be gradual and not sudden, (4) and no grinding should be performed with the edge of the wheel.

The life of a grinding wheel is usually rated from the number of pounds of metal removed before the wheel has ceased to be effective in production operations. Wheel life averages between 5,000 to 7,000 lb of metal removed at a rate of 300 to 500 lb per hour.

Wet-Belt Grinding—or machining utilizes a coolant of one part soluble oil to thirty parts of water. A suitable wetting agent and water softener (sequestrant) should be added to the coolant. The coolant aids in adhering the belt to the work. The pressure required is over 450 psi, which is obtained by oscillation of the belt. Large flat areas of 16 sq in. and even greater may be belt ground.

The Milling Process

By Mario Martelloti

DEVELOPMENT ENGINEER
THE CINCINNATI MILLING MACHINE COMPANY

MILLING IS A process of producing machined surfaces by progressively removing a predetermined amount of stock from the workpiece, which is advanced at a relatively slow rate of movement or feed to a milling cutter rotating at comparatively high speed.

Cutting Speed

The speed of a milling cutter, known as peripheral or surface speed, is usually expressed in feet per minute, for a known cutter diameter D inches, and revolutions N per minute, I + can be computed by means of the following formula:

$$C = \frac{\pi \, D \, N}{12} \qquad (1$$

The difference in cutting speed is due primarily to the fact that different cutting materials, for example, high speed steel and sintered carbide, offer different degrees of resistance to the heat generated while milling, and also to the fact that certain work materials, as for example, alloy steel and aluminum, offer different cutting resistance. Therefore a correspondingly higher cutting speed can be used when the cutting resistance is low, as in the case of aluminum, than when it is high as it will be in the case of alloy steel. When in a relatively soft state, steel can generally be milled at higher cutting speed than is possible after hardening.

The tensile strength is one of the physical properties of a material which has been found to give a practical indication of the cutting speed to use in machining (Fig. 1).

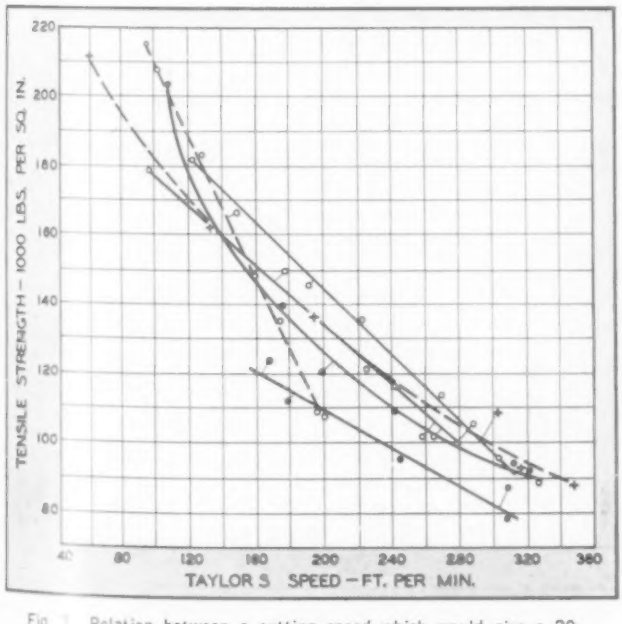


Fig. 1. Relation between a cutting speed which would give a 20-minute tool life and tensile strength of special steels (Bureau of Standards Research Paper No. 319, Page 985).

Both the tensile strength and Brinell hardness number of ferrous and non-ferrous materials can also be approximately related by a straight line (Fig. 2). This permits determination of the value of one in terms of the other with sufficient accuracy for practical use.

The approximate relationship between the cutting speed for different cutting materials and the materials to be cut can then be represented by charts, as shown in Figs. 3, 4 and 5.

From these charts an approximate range can be obtained of the cutting speed to use in milling a given material. Magnesium and aluminum alloys are milled with sintered carbide cutters within a wide range of cutting speeds. Cutting speeds from 3,500 to 12,000 feet per minute and higher have been used when milling these materials.

The selected speed may have to be adjusted in the actual operation to provide satisfactory cutter life, good finish of the milled surface, and operation of the machine within the power available from the driving motor. From the value of the selected cutting speed, the revolutions per minute of the cutter can be calculated from formula 1.

Rate of Stock Removal

The rate at which stock is removed is measured in cu. in. per minute and is determined by the workpiece feed rate F, ipm, and depth d and the width w of cut in inches as follows:

$$V = d \; w \; F \qquad (2$$

Feed Per Tooth

The feed per tooth indicates the amount of material removed by each tooth from the workpiece, while it is feeding at the rate of F inches per minute (*The Tool Engineer*, July, 1949, page 35, Fig. 20, Milling Cutter Design and Operation). For a given width and depth of cut, the feed per tooth is a measure of the load on the milling cutter tooth.

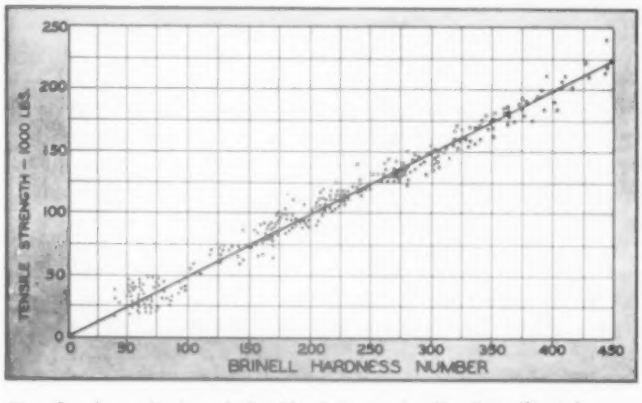


Fig. 2. Approximate relationship between tensile strength and Brinell hardness number, obtained from values of a large number of various ferrous and non-ferrous materials.

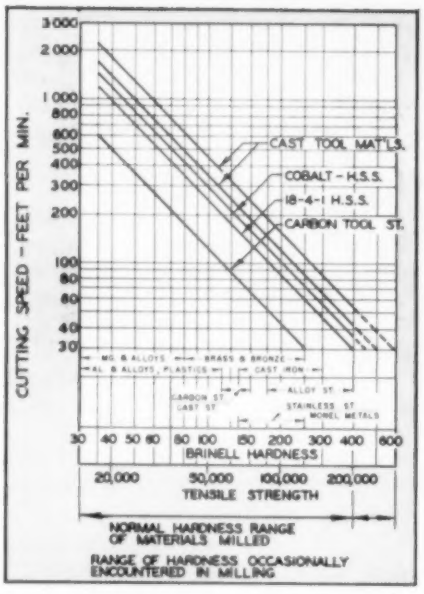


Fig. 3. Relationship between the Brinell hardness of milled parts and speed of cutter for various tools and work material.

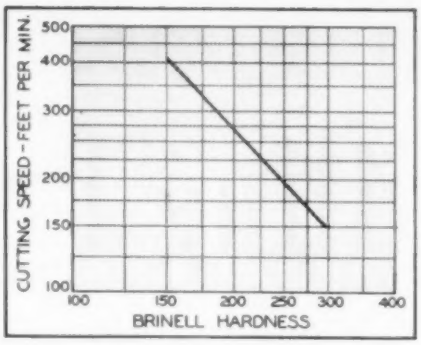


Fig. 4. Relationship between the Brinell hardness number of the parts to be milled and the cutting speed of the milling cutter in milling cast iron with sintered carbide tipped cutters.

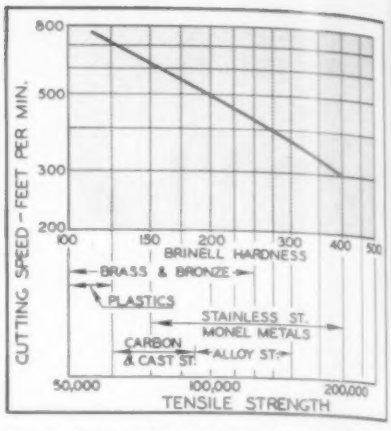


Fig. 5. Relationship between Bhn of parts and cutter speed on steel with sintered carbide tipped cutters.

The feed per tooth F_t is determined from the feed rate F, inchs per minute, the number of teeth T in the cutter, and revolutions per minute N of the cutter as follows:

$$F_t = \frac{F}{T\ N} \qquad (3$$

By combining formulas 2 and 3, the rate of stock removal can be expressed as follows:

$$V = d\ w\ T\ N\ F \qquad (4$$

In practice it is necessary to establish values of the feed per tooth in relation to the types of cutter and work material; the rigidity of the part to be milled; the rigidity of the machine and fixture; and the power available in the milling machine. For example, in milling deep, narrow slots in a part made of aluminum alloy material with a high speed circular saw, the feed per tooth may not be greater than 0.001 in., while in milling with a face mill or a slab mill, a part made of the same material having strong sections and rigidly supported, a feed per tooth of 0.02 in. and higher is possible.

The range of values for different types of milling cutters and kinds of work material, subject to adjustment in relation to conditions obtained in actual milling operations, is given in Tables I and II.

The values of feed per tooth must be scaled down where the depth of cut is great or the cutter or work are fragile in nature. It should be kept in mind, however, that from the production standpoint of efficiency of metal removal and freedom from chatter, the feed per tooth with any kind of cutter should be as high as possible. Proper cutter design and the correct tooth angles will permit increasing the values of feed per tooth given in Table I and II.

The thickness of material which can be removed by a tooth efficiently and without damaging effects to the milled surface or the cutter, depends to a great extent on the ease of flow of the material of the chip along the face of the tooth. Under average conditions, however, and especially when taking finishing cuts, the feed per tooth is generally lower than suggested in Tables I and II. One-half and even one-third of these values are frequently used.

With *sintered carbide tipped cutters* the feed per tooth must often be reduced below the values given in Table II, because of limitations imposed by the cutter design and power available in the machine. With milling cutters made of *carbon tool steel*, the feed per tooth is one-half of the value given in Table I, and with cutters having the teeth made of *cast non-ferrous tool material*, the feed per tooth is the same as that used with sintered carbide tipped cutters.

The life of milling cutters, measured by the number of pieces or parts milled between resharpening is affected by the feed per tooth (Fig. 6). As the feed per tooth is increased, the wear on the flank or clearance increases, giving a correspondingly shorter cutter life for higher feeds per tooth.

At values of feed per tooth lower than those shown in Fig. 6, the wear on the clearance side of the teeth increases, the cutter life is correspondingly shorter than it is at higher feed per tooth. A too small or too large feed per tooth will produce a greater amount of wear than the *medium* value of feed per tooth with a correspondingly lower cutter life.

Power Required in Milling

The power required to remove a given amount of stock from the workpiece in milling depends on many factors. These include the kind of work material, its physical properties, the depth and width of cut, rate at which metal is removed as determined by the feed rate, type of cutter material, tooth angles and particularly the rake angle, length of cutting edge engaged in the cut, cutting speed and cutting fluid.

The cutting material and the material to be cut determine the cutting speed (Figs. 1, 2 and 3). The cutter design and the material to be cut determine the feed per tooth and, consequently, the feed rate (Tables I and II). The power that can actually be used in milling operations is determined by the strength and rigidity of both the milling cutter and the workpiece.

The power required at the cutter in milling can be evaluated by means of the following formula:

$$H_p = a\ V\ ^3/_4 \qquad (5$$

where V is the rate of stock removal (formula 2), and a is a

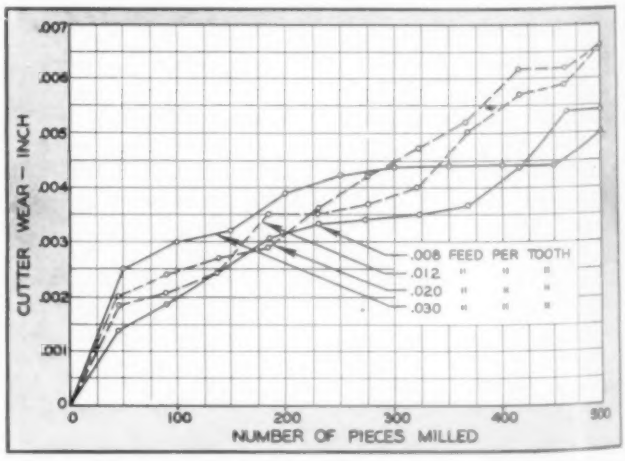


Fig. 6. Life of sintered carbide tipped face mill as determined by the number of pieces milled for a given amount of wear and for different feeds per tooth.

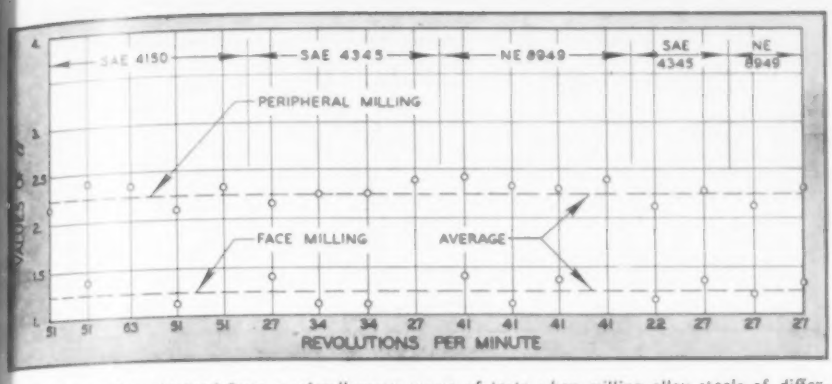


Fig. 7. Values of a, obtained from a miscellaneous group of tests when milling alloy steels of different hardnesses, depths and widths of cut and feed rates with various types of high speed steel faces and peripheral mills. Materials tested: SAE 4345, 330 BHN; SAE 4150, 190 BHN and NE 8949, 240 BHN. Cutting speeds: 27 to 60 ft. per minute. Cutting fluid: water soluble mix. Peripheral Milling: Widths of cut: 1-7/8 to 5 in. Depths of cut: 1/32 to 1/4 in. Face Milling: depths of cut 1/16 to 1/4 in.; widths of cut 1-7/8 to 4-3/4 in.

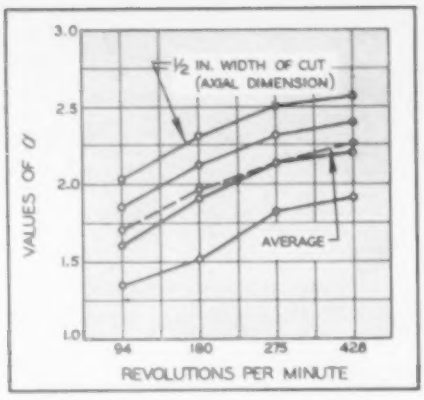


Fig. 8. Average value of a for different depths of cut and cutter rpm on alloy steel with sintered carbide face mill. Material: NE 8360, 200 BHN. Cutter: 8-1/2 in. diam., 10 teeth 10° to 15° negative axial and radial rake angles, 3° clearance, 1/4 x 45° chamfer. 3-1/4 in. width of cut. Feed rates: 9 to 35 ipm. Cutting speed: 210 to 952 fpm—no cutting fluid used. (From WPB Report No. 19.)

factor which *represents the power used when removing any particular material at the rate of stock removal of one cu. in. per minute.*

The value of the factor *a* is affected by many variables, such as the physical properties and microstructure of the material being cut, cutting speed, depth and width of cut, tooth angles, sharpness of the cutting edge of the teeth, and cutting fluid, but its variation for any given material is relatively small.

The maximum, minimum and average values of *a* obtained from a large number of tests with milling cutters of different types and operating within practical ranges of cutting speed, width and depth of cut on various work materials, are given in Table III. *Since many of the values of a fall within 25 per cent above and below the average value of a this value can be used to determine with sufficient approximation the horsepower required at the cutter.*

When a closer determination of *a* is desired, this should be selected with due consideration of the cutting conditions, since *a* increases with the cutting speed the depth and width of cut and the hardness of the material being cut (Figs. 7, 8, 9 and 10). If the product of the depth and width of cut is large, a value of *a* above the average should be selected; conversely, if the product is small, a value of *a* less than average should be used. At high cutting speeds the value of *a* should be somewhat higher than the average; conversely,

Table I—Suggested Feed Per Tooth for High Speed Steel Milling Cutters

Material	Face Mills	Helical Mills	Slotting & Side Mills	End Mills	Form Cutters	Circular Saws
Plastics	.013	.010	.008	.007	.004	.003
Magnesium and Alloys	.022	.018	.013	.011	.007	.005
Aluminum and Alloys	.022	.018	.013	.011	.007	.005
Free Cutting Brasses and Bronzes	.022	.018	.013	.011	.007	.005
Medium Brasses and Bronzes	.014	.011	.008	.007	.004	.003
Hard Brasses and Bronzes	.009	.007	.006	.005	.003	.002
Copper	.012	.010	.007	.006	.004	.003
Cast Iron—Soft 150-180 B.H.	.016	.013	.009	.008	.005	.004
Cast Iron—Medium 180-220 B.H.	.013	.010	.007	.007	.004	.003
Cast Iron—Hard 220-300 B.H.	.011	.008	.006	.006	.003	.003
Malleable Iron	.012	.010	.007	.006	.004	.003
Cast Steel	.012	.010	.007	.006	.004	.003
Low Carbon Steel, Free Machining	.012	.010	.007	.006	.004	.003
Low Carbon Steel	.010	.008	.006	.005	.003	.003
Medium Carbon Steel	.010	.008	.006	.005	.003	.003
Alloy Steel, Annealed 180-220 B.H.	.008	.007	.005	.004	.003	.002
" " Tough 220-300 B.H.	.006	.005	.004	.003	.002	.002
" " Hard 300-400 B.H.	.004	.003	.003	.002	.002	.001
Stainless Steels, Free Machining	.010	.008	.006	.005	.003	.002
Stainless Steels	.006	.005	.004	.003	.002	.002
Monel Metals	.008	.007	.005	.004	.003	.002

Table II—Suggested Feed Per Tooth for Sintered Carbide Tipped Cutters

Material	Face Mills	Helical Mills	Slotting & Side Mills	End Mills	Form Cutters	Circular Saws
Plastics	.015	.012	.009	.007	.005	.004
Magnesium and Alloys	.020	.016	.012	.010	.006	.005
Aluminum and Alloys	.020	.016	.012	.010	.006	.005
Free Cutting Brasses and Bronzes	.020	.016	.012	.010	.006	.005
Medium Brasses and Bronzes	.012	.010	.007	.006	.004	.003
Hard Brasses and Bronzes	.010	.008	.006	.005	.003	.003
Copper	.012	.009	.007	.006	.004	.003
Cast Iron—Soft 150-180 B.H.	.020	.016	.012	.010	.006	.005
Cast Iron—Medium 180-220 B.H.	.016	.013	.010	.008	.005	.004
Cast Iron—Hard 220-300 B.H.	.012	.010	.007	.006	.004	.003
Malleable Iron	.014	.011	.008	.007	.004	.004
Cast Steel	.014	.011	.008	.007	.004	.004
Low Carbon Steel, Free Machining	.016	.013	.009	.008	.005	.004
Low Carbon Steel	.014	.011	.008	.007	.004	.004
Medium Carbon Steel	.014	.011	.008	.007	.004	.004
Alloy Steel, Annealed 180-220 B.H.	.014	.011	.008	.007	.004	.004
" " Tough 220-300 B.H.	.012	.010	.007	.006	.004	.003
" " Hard 300-400 B.H.	.010	.008	.006	.005	.003	.003
Stainless Steels, Free Machining	.014	.011	.008	.007	.004	.004
Stainless Steels	.010	.008	.006	.005	.003	.003
Monel Metals	.010	.008	.006	.005	.003	.003

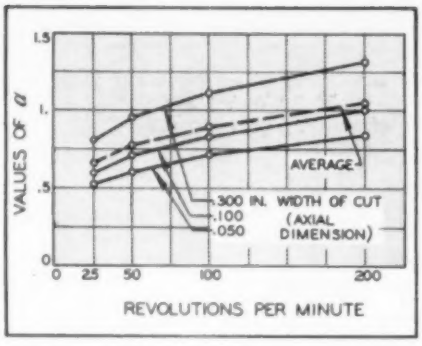


Fig. 9. Average values of a obtained when milling cast iron with a sintered carbide face mill. Material: Meehanite cast iron, 20,000 to 40,000 psi. Tensile Strength, BHN 170 and 190, respectively. Face Mill: 9 in. diameter, 16 teeth, 7° positive axial and 4° positive radial rakes, 0.07 x 45° chamfer. 2 Width of cut, 4-3/8 in. (War Production Board Reports 8-45 and 9-45.)

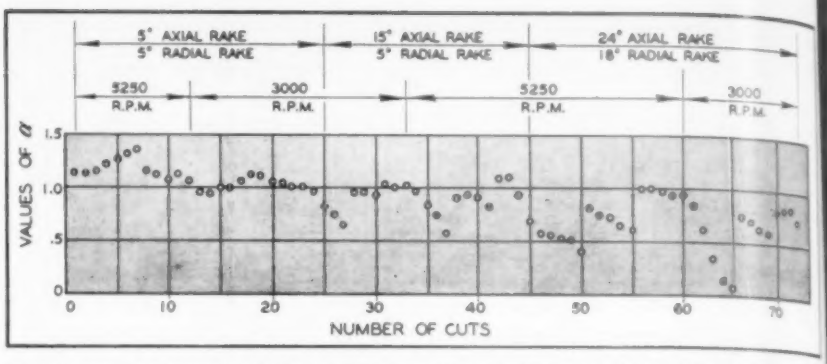


Fig. 10. Average values of a obtained on aluminum alloy with sintered carbide peripheral milling cutter. Material: 145-T Al. Milling cutter: 8 in. diam., 4 teeth positive radial and axial rake angles, 4° clearance angle—Width of cut, 1 in. Depth of cut, 1/4 to 7/8 in. Feed rates: 50 to 200 ipm. Cutting fluid: Water soluble mix. (WPB Report No. 15.)

at low cutting speeds, the value of a should be lower than the average. This is particularly applicable to milling with sintered carbide materials, since in this case the cutting speed varies within wider limits than with high speed steel cutters.

The effect of cutting fluids on the value of a is limited only to that produced by the particular kind of cutting fluid used, and it is usually small. Similarly, the effect of rake angles on the value of a within the range used in practice is usually small.

The horsepower at the cutter obtained from formula 5 does not take into consideration the power actually required to drive the machine.

The mechanical efficiency of any machine depends upon the load transmitted by the machine drive and the speed at which it operates. Because of losses in the spindle and feed drives, the efficiency of a milling machine will vary over a wide range, depending on the magnitude of the power used.

An approximate value of the mechanical efficiency of a milling machine at any load can be calculated by assuming that the horsepower lost or used up in the drives is constant throughout the load range and equal to the power input to the machine when the spindle and table operate at no load. This power is then subtracted from the power input to the drives when milling, and the mechanical efficiency E in percent is then obtained from the following formula:

$$E = \frac{100\ Hpd - H1}{Hpd} \qquad (6$$

where:

Hpd = Horsepower input to the machine.
H1 = Horsepower input to the machine when operating idle.

The difference Hpd — H1 = Hp is the horsepower at the cutter (formula 5).

The relation between the total power input to the machine and the rate of stock removal can then be obtained by combining formulas 5 and 6. Hence:

$$Hpd = \frac{a\ V^{3/4}}{E} \qquad (7$$

The highest efficiency of a machine is obtained at the lowest spindle speed and highest cutter load, and, conversely, the lowest efficiency results at the highest speed and lowest cutter load.

An example of the application of formula 7 follows: Milling alloy steel 190-200 Brinell with a four-tooth sintered carbide tipped cutter. Given:

Feed per tooth, $F_t = 0.011$ in.; number of teeth — T = 4; rpm N = 357; depth of cut, d — 0.100 in.; machine efficiency, E = 0.80; value of $a = 2$.

The rate of stock removal is (formula 4):

$V = 0.011 \times 4 \times 357 \times 0.100 \times 4 = 6.30$ cu. in. per minute.

$V^{3/4} = (6.30)^{3/4} = 10$ hp.

Therefore, from formula 7:

$$Hpd = \frac{2 \times 4}{0.8} = \text{hp}$$

The power required at the cutter and the power input to the machine, the cutter rpm, the rate of stock removal, for given values of the cutting speed, feed per tooth, width and depth of cut, cutter material and material to be cut, number of teeth in the cutter, and the assumed value of the factor a can also be obtained from the nomograph of Fig. 11.

Example Showing the Application of Milling Nomographs

Find the horsepower at the cutter and the horsepower input to the machine, the feed rate, rate of stock removal

Table III

Range of Values of a Obtained in Various Milling Operations with High Speed Steel and Sintered Carbide Cutters

Type of Milling Cutter	Cutting Material	Material Cut		Values of a		
		Kind	Brinell Hardness Number	Minimum	Maximum	Average
1. Face Mills; Shell End Mills; Plain Mills; 50° and 70° Helical Mills	High Speed Steel	S.A.E. 4345 Steel S.A.E. 4150 Steel N.E.8949 Steel S.A.E. 3145 Steel	330 190 240 180	0.90	1.45	1.25
2. Face Mills	High Speed Steel	Cast Iron	170	0.51	1.01	0.76
3. Plain Mills	High Speed Steel	Cast Iron	170	1.15	1.45	1.30
4. Form Relieved Cutters	High Speed Steel	S.A.E. 1020 Steel	160-170	1.48	2.45	1.96
5. Plain Mills	High Speed Steel	S.A.E. 1020 Steel	160-170	2.10	2.90	2.50
6. Face Mills	Sintered Carbide	N.E. 8630 Steel	200	1.50	2.50	2.00
7. Face Mills	Sintered Carbide	Cast Iron	190	0.50	1.00	0.75
8. Peripheral Mills	Sintered Carbide	14 S-T Aluminum Alloy	...	0.50	1.00	0.75

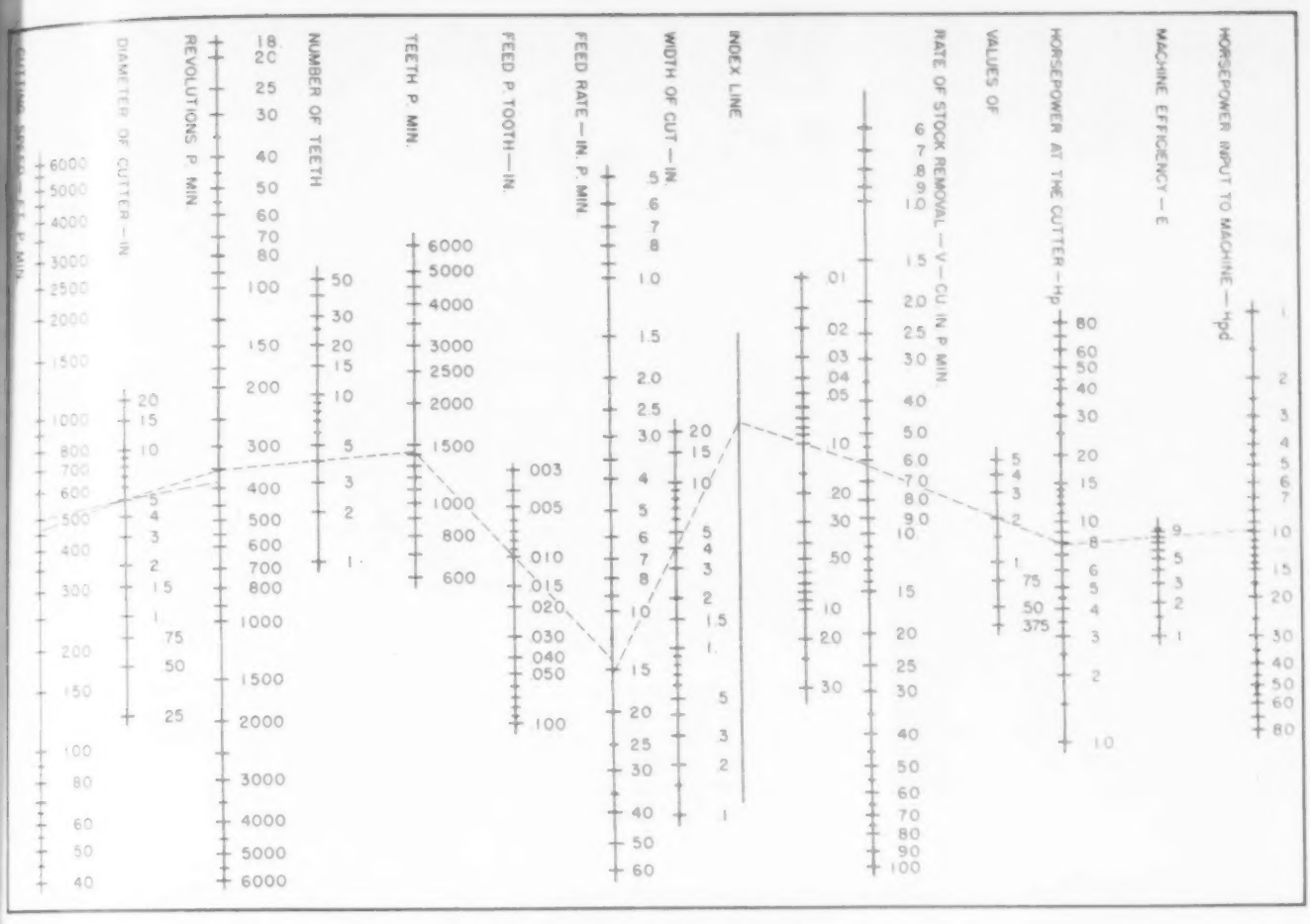


Fig. 11. Nomograph for milling calculations.

to mill an alloy steel block of 190-220 Brinell hardness, using a 5 in. diameter, four-tooth sintered carbide face mill. The depth of cut is 0.100 in., the width of cut is 4 in., and the feed per tooth is 0.010 in. (Table II). The cutter has —10 deg axial and radial rake angles.

1. The tentatively selected cutting speed from Fig. 5 is 500 fpm. This will be adjusted to the nearest rpm available in the machine.

Starting on the cutting speed scale (Fig. 11), a straight line is drawn from 500 point on this scale through point 5 on the cutter diameter scale. This line intersects the rpm scale at approximately 380 rpm. Assuming the 357 is the nearest rpm available in the machine used for this job, the actual cutting speed will be found by proceeding in reverse order from 357 on the rpm scale through point 5 on the cutter diameter scale, and thence to the cutting speed scale. The actual value of the cutting speed is then found to be 460 fpm.

Determining Feed Rate

2. The *feed rate is* found by connecting 357 to point 4 on the number of teeth scale. The intersection on the number of teeth per minute scale is connected with 0.010 in. on the feed per tooth scale, and is continued to intersect the feed rate scale. This point reads approximately 14 ipm. The nearest feed available in the machine is 15⅜ ipm. Hence, proceeding in reverse order, it is found that the actual feed per tooth is 0.011 in.

3. The approximate rate of stock removal is obtained by proceeding from point 15⅜ on the feed rate scale to point 4 on the width scale and from the intersection of this line with the index line to point 0.100 in. on the depth of cut scale to intersect the rate of stock removal scale. This is intersected at a point reading approximately 6.3 cu. in. per min.

4. The power required at the cutter is calculated by assuming for the factor *a* the average value of 2 (Table III). From point 6.3 on the rate of stock removal scale a line is drawn through point 2 on the *a* scale intersecting the horsepower at the cutter scale. The approximate value indicated here is 8.0 hp. By varying the value of *a* from the average value, the corresponding effect on the power at the cutter can be readily found.

Power Requirements

5. To find the hp input to the machine, a value of 80 percent efficiency is assumed for the spindle drive. A line drawn from 8.0 through 0.80 on the efficiency scale intersects the hp input to the machine scale at a point reading approximately 10 hp.

If this power is higher than the rated capacity of the electric motor driving the machine, a reduction must be made in the feed rate. If the reduction results in a too low feed per tooth, the cutting speed should be reduced correspondingly to increase the feed per tooth within a satisfactory value.

Conversely, if the power value is lower than that which the motor can supply, the selected values may be revised with the object of utilizing the full power available, providing that the setup will permit the use of the maximum power of the machine.

Articles by Mr. Martellotti on milling subjects appeared in the June, July and August issues of THE TOOL ENGINEER

North East West South IN INDUSTRY

In several changes announced recently by **Firth Sterling Steel and Carbide Corp.**, **A. E. Barker**, former district sales manager, was named assistant to the president. At the same time, **C. R. Harmon**, manager of the Pittsburgh district, was appointed sales manager, and **J. M. Stokes**, of the Detroit office, was named assistant sales manager, carbide sales division. **J. J. Sowko** was appointed Pittsburgh branch sales manager.

C. R. Harmon

Robert P. Melius

William A. Marsteller, for many years manager of advertising, has been elected a vice president of **Rockwell Manufacturing Co.**, Pittsburgh. At the same time **Robert P. Melius**, sales manager of the Delta division of the company, was named vice president of the company in charge of sales of the newly-created power tools division.

Purchase of the **Rockford Magnetic Products Co., Rockford, Ill.**, has been announced by the **Sundstrand Machine Tool Co.** As a subsidiary of Sundstrand, the company will be operated under the name of **Sundstrand Magnetic Products Co.**

F. B. Atwood, formerly supervisor of industrial engineering and production control, has been appointed manufacturing superintendent of the radio tube plant of **Sylvania Electric Products, Inc.**, at Huntington, W. Va.

E. R. Oeschger has been named manager of the foundry divisions of **General Electric's** apparatus department, a new post. Foundries comprising the new divisions are located in Elmira, N. Y., Erie, Pa., Everett, Mass., Lynn, Mass., Schenectady, N. Y.

John J. Summersby has been elected vice president, sales, of **Worthington Pump and Machinery Corp.** At the same time **Thomas J. Kehane** was named assistant vice president and general sales manager.

Landis Machine Co., Waynesboro, Pa., has announced an increase in office, manufacturing and research space of approximately 50,000 square feet.

W. E. Mahin, chairman of metals research, has been appointed director of research of **Armour Research Foundation** of Illinois Institute of Technology.

Lawrence C. Whitsit, formerly assistant chief inspector, has been named quality engineer of the Kelvinator division, **Nash-Kelvinator Corp.**

George Zahn, for many years sales manager of the Instrument division of **Stewart-Warner Corp.**, has been appointed assistant for marketing to F. A. Hitler, Stewart-Warner vice president.

John W. Belanger, assistant general manager of the Apparatus department of General Electric Co., has been elected to the board of directors of **Allegheny-Ludlum Steel Corp.** Mr. Belanger succeeds Henry V. Erben, GE vice president, who resigned.

Edwin D. Scott, for many years associated with automotive body engineering in the Detroit area, has joined **Peninsular Metal Products Co.**, as chief engineer.

Coming Meetings

Sept. 26-28, **National Electronic Conference**; conference and exhibition. Edgewater Beach Hotel, Chicago.

October 17-21, **American Society for Metals**; annual meeting. Cleveland. (**National Metal Congress**, concurrently, Cleveland Public Auditorium.)

October 17-21, **American Welding Society**; annual meeting. Cleveland.

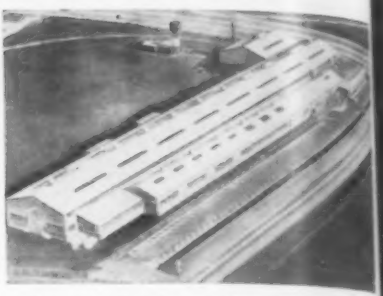
October 17-21, **American Institute of Mining and Metallurgical Engineers**; fall meeting. Cleveland.

October 17-21, **Society for Non-Destructive Testing**; annual meeting. Cleveland.

October 27-28, **Gray Iron Founders' Society, Inc.**; annual meeting. Edgewater Beach Hotel, Chicago.

October 27-29, **American Society of Tool Engineers**; Seventeenth Annual Meeting. Mount Royal Hotel, Montreal, Quebec. (H. M. Windsor, ASTE, 10700 Puritan Ave., Detroit 21, for reservations.)

November 2-4, **Industrial Management Society**; Annual Time and Motion Study Clinic. Sheraton Hotel, Chicago.



Revere Copper and Brass, Inc., has announced that its Pacific Coast division at Los Angeles is now in full operation. The new plant has complete facilities for fabricating refined copper through to finished products, as well as equipment for the handling of copper and brass scrap from local manufacturing plants.

Orrin G. Meyers, formerly chief engineer, was recently named sales manager of **Hunter Spring Co.** (formerly Hunter Pressed Steel Co.). A graduate of Penn State, Mr. Meyers joined Hunter in 1937.

John Soelch, formerly assistant, has been appointed director of purchases of **The Studebaker Corp.**, it was announced by P. O. Peterson, vice president, manufacturing. He will succeed C. N. Rhoutsong, who has resigned because of ill health.

Leo J. Pantas has been named works manager of **The Yale and Towne Manufacturing Company's** Salem, Va., plant, it has been announced. Mr. Pantas was formerly manager of the Buffalo, N. Y. plant.

The Hartford Special Machinery Co., through the acquisition of the **Langelier Manufacturing Co.**, Cranston, R. I., has added three lines to its machinery products, including drilling machinery, an automatic thread roller and a die polishing machine.

Robert H. Davies has joined **Baker-Raulang** as manager of engineering, in which position he will supervise all engineering functions of the company. Mr. Davies comes from Lincoln Electric Co., where he served as representative and consultant on educational work.

Frank Ross, formerly national manager of lubrication for **E. F. Houghton & Co.**, has been appointed to the newly-created post of assistant to the vice president, sales.

Edmund B. Neil, consulting engineer, Columbus, Ohio, has joined **Francis W. Davis**, consulting engineer of Waltham, Mass., as midwest associate on automotive engineering problems.

OBITUARY

William F. Slomer, former general sales manager of **The Fellows Gear Shaper Co.**, died recently at his summer residence at Hendersonville, N. C. Mr. Slomer joined Fellows in 1903, and became general sales manager in 1908.

Left: Second largest seaport in America, Montreal has miles of berths and dock facilities for inland and ocean-going shipping. Top right: Lafontaine Park is one of the numerous breathing spots dotting Canada's major metropolis. Below: Open air observation cars give an Old World feeling as they tour the ancient and modern sections.

Montreal

A. S. T. E. NEWS
Doris B. Pratt
Editor

Manufacturing Hub of World's Fourth Industrial Producer to Entertain Society October Convention Will Stress Economical Tooling for Short Run Production

WHILE MUCH of the world has been trying to clear a fight-groggy head and get on its feet industrially, Canada has been climbing to new manufacturing heights. In 1939 it ranked eighth as a world producer; now it is considered fourth, exceeded only by the United States, Russia and Great Britain.

According to the latest figures available for this period, in the iron and iron products field alone Canadian establishments increased from 1394 to 2358; number of employees jumped from 121,042 to 249,279; consumption of fuel and electricity totalled $34,739,295 against $7,111,654. Goods processed rose from $203 million to $635 million, with gross value of production soaring from $392,657,759 to $1,405,542,865.

Good Tools Increased Wealth

During the war, when the United States' northern neighbor learned the value of correct tooling applied to accurate, high speed machines, it chucked its antiquated machinery. All of its improved and expanded facilities have been retained in peacetime output. Using modern equipment, the metalworking field has more than trebled production while only doubling its working force.

This new industrial prominence will impress ASTE visitors attending the Society's 17th semi-annual meeting at Mount Royal Hotel, Montreal, Que., October 27-29.

In order to satisfy a limited demand for consumer goods at prices comparable to United States mass-produced merchandise, Canadian industry has become ingenious in devising low cost, versatile tooling. And for many manufacturers below the border, facing slackening markets and wavering prices, the ASTE convention theme, "Economical Tooling for Short Run Production," is timely.

Saving with Standard Parts

First approach to the problem is a lecture, "Application of Standard Tool Parts to Cut Costs," on Thursday afternoon. W. Arthur Thomas, superintendent of tool engineering, Ford Motor Co. of Canada, Ltd., Windsor, Ont., is the speaker; Leonard G. Singer, district manager for Williams & Wilson, Ltd., Toronto, Ont., chairmans the session.

The automotive production executive will detail tool standards and tooling for multiple drill operations and development of tool standards for turning and facing operations on Bullard vertical indexing machines. He will describe die design for automotive sheet metal parts, gun welder design and miscellaneous machine operations, explaining the application of tool standards in each case.

A concurrent session will feature Islyn Thomas, president, Thomas Manufacturing Corp., Newark, N. J. and Edmund W. Spitzig, hobbing supervisor, Newark Die Co., also of Newark. An accompanying speaker on "Mold Die Finishing" and the session chairman had not been announced at press time.

Highlight of the technical program is expected at the Thursday evening session, "A New Concept of Surface Measurement." This will be the first public discussion of a new method being developed by two Detroit automobile builders.

Arthur F. Underwood, head, and Roy P. Trowbridge, project engineer, mechanical engineering department 5, Research Laboratories Div., General Motors Corp., Detroit, will collaborate in presenting "Surface Finish Control and the Making of Master Standards."

After a resume of ASA and SAE standards on surface finish, they will point out advantages and drawbacks of the most used "standard" sets of typically machined surfaces, displaying examples.

Originals Ruled in Gold

For positive measurement of surface irregularities, a set of accurate roughness standards is being developed. Masters, ruled in gold, are reproduced by an electroforming process. With photographs the research men will demonstrate how these reference standards are made, as well as the machine and methods.

Dr. Clayton R. Lewis, staff research engineer, Chrysler Corp., Detroit, will continue with a paper, "Calibration of Master Roughness Standards and Their Use."

Since utilizing surface roughness standards depends on exact knowledge of size and shape of surface irregularities, measurements to the precision of a few percent of a wave length of light are necessary.

An ingenious method of taper section-

Built in 1705 as a residence for early governors from France, Chateau de Ramezay is now a museum furnished with specimens of the late French and early English regimes.

ing originally developed at Battelle Institute has been adapted to the problem. This gives as much as 25 times extra magnification in one direction of the sample. Dr. Lewis will describe its use, the character of typical surfaces as disclosed by this technique, and probable fields of application.

Chairman for the meeting is Gerald A. Rogers, sales engineer, Rudel Machinery Co., Ltd., Montreal.

How to evolve "Special Purpose Machines from Standard Units," will be explained by Edgar L. Barker, president, Modern Tool Works, Ltd., Toronto, Ont., on Friday morning. He will consider special machinery for automobile, farm implement and general manufacturing where total amortization cost must be absorbed over a limited volume of components.

Samuel Pedvis, sales manager, Upton Bradeen & James, Ltd., Montreal, will introduce Mr. Barker.

A. B. Chevrier, sales engineer at Upton Bradeen & James, will preside at a simultaneous session devoted to "Use of Low Melting Point Alloys for Tool and Die Work." Speaker for this meeting has not been named.

Two phases of "Low Cost Tooling—Estimating and Economics" are scheduled for Friday afternoon with John R. Houghton, assistant superintendent, manufacturing methods, Telephone Div., Northern Electric Co., Montreal, presiding.

G. M. Foster, assistant superintendent of manufacturing engineering at Northern Electric, will tell factors to be considered in "Predesign Estimating" for tooling a given product.

In dealing with "Postdesign Estimating," George S. Clarke, assistant superintendent of machine and tool manufacturing in the same division of Northern Electric, will show steps in building up a detailed estimate for the tooling determined prior to designing.

Another session for Friday afternoon also is being planned by the National Program Committee.

The evening meeting, headed "Hot Machining," is under the direction of James O. Horne, sales manager, James O. Horne & Co., Rochester, N. Y.

J. R. Roubik, lecturer in mechanics, Marquette University and research department, Kearney & Trecker Corp., Milwaukee, Wis., will deliver a talk, "Milling Hot Workpieces," prepared jointly with A. O. Schmidt, research engineer at Kearney & Trecker.

To Tell Research Findings

Their report of experimental work in thermoanalysis of metal cutting will emphasize application of laboratory data to the machining of high-strength alloys by heating the workpiece, comparative tool life studies, power data, possibilities and limitations of hot milling.

Sam Tour, board chairman of Sam Tour & Co., Inc., New York City, is to present "Hot Spot Machining."

With customers demanding higher quality and manufacturers becoming more competitive, statistical quality control is a logical method of attacking the dilemma. So John K. MacKeigan, chief inspector, Tire Div., Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont., will tell the final technical session audience on Saturday morning.

He will show how controlling quality by sampling chart data is often helpful in measuring process capability, facilitating inspection and reducing scrap.

T. J. Tracey, sales engineer, Canadian General Electric Co., Ltd., Montreal, will have charge of the closing meeting.

On Thursday and Friday, buses will carry members to plants in and around Montreal to view some of the operations described by the technical speakers. These trips are outlined in later pages.

Only scheduled business session is the semi-annual board meeting on Friday when directors-elect will be sworn into office.

On the social side the Host Chapter will introduce their city in a program of scenic films Thursday morning. At noon Camillien Houde, mayor of Montreal, will officially welcome the Society during a luncheon to be addressed by a local industrialist.

A Day in the Mountains

Saturday there will be a day-long motor tour of the Laurentians, some of the world's oldest mountains. The road will lead through quiet French-Canadian villages, past fragrant pines, along rushing streams and placid lakes. Destination will be a luxurious resort hotel for a leisurely luncheon stop.

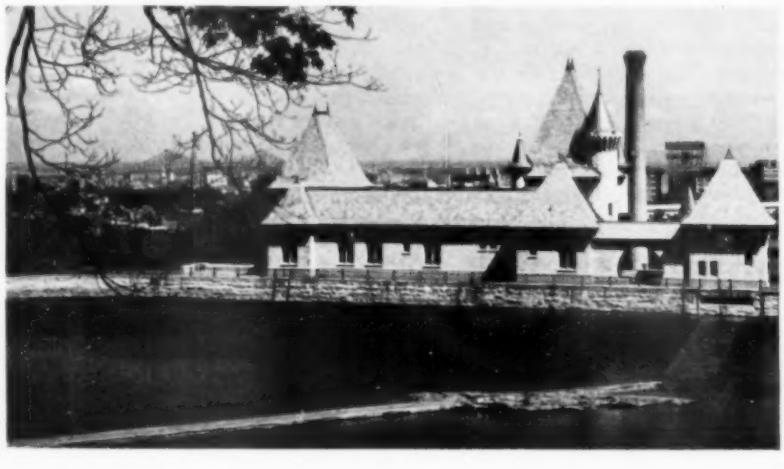
That evening everybody will get together in the Mount Royal ballroom for a reception and banquet. Clarence D. Howe, minister of reconstruction and supply and of trade and commerce for the Government of Canada, will discuss his country's industrial development and prospects. A distinguished professional engineer responsible for all nuclear fission research there, Minister Howe recently stated that Canada could make atomic bombs.

A sparkling floor show, to go on after the speaking program, will conclude the evening.

* * *

For the ladies there will be a special program. Models will parade fall and winter styles at a fashion show luncheon in the Mount Royal Palm Court. Other events include trips through the plants of National Breweries, Imperial Tobacco Co. and Distillers Corp.

Marc A. Cote, Montreal chapter chairman, heads the host chapter committees. Technical program is under the direction of Fred J. Schmitt of Chicago, national



Left: Looking over the city from Mount Royal, the visitor sees Jacques Cartier Bridge linking Montreal with Sainte Helene Island. Old stone forts on the island have survived both French and English rule. Right: A horse-drawn caleche starts out on a drive to the mountain park, which is closed to automobiles.

program chairman, Gerald A. Rogers, local program committee representative, and James O. Horne of Rochester, N. Y., also a program committeeman.

* * *

You'll want to save some time for seeing the town by bus, open-top sightseeing trolley or horse-drawn caleche. One of the oldest cities in North America, Montreal was settled over three centuries ago. Surrounded by French cafes, dazzling night clubs, more churches and chapels than in Rome, stone forts and ultra-modern buildings, a tenth of the conutry's 13 million people live in the metropolitan area.

Starting from Dominion Square you'll pass fine department stores, smart shops, theatres, financial houses, and Chinatown. As you step into Notre Dame Church in the old French section, you're astonished to find it can accommodate 10,000 worshippers. In one of its belfries swings a 12-ton bell, largest on the continent.

Built Around Dead Volcano

In Notre Dame de Bonsecours Church, sailors' families seek divine protection for those at sea. Throughout Bonsecours Market, you'll hear spirited bargaining in two languages.

Climbing the hilly side you come to the Scotch baronial buildings of McGill University. Farther on pilgrims constantly toil up the long steps to St. Joseph's Oratory. Nearby at Musee Historique Canadian, lifelike wax figures portray Canada's history. From Mount Royal Park, a once-volcanic bulge that provides a natural lookout, the Adirondacks rise dimly beyond the St. Lawrence.

Shopping for Canadian and foreign goods and habitant handicrafts is an added attraction. Before entering Canada, visitors from the United States can stretch their shopping funds by converting them into Canadian drafts at the prevailing discount. American currency is accepted at par in Canada.

Duty-Free Limit $400

Returning tourists may bring $100 worth of merchandise into the United States after a 48-hour stay, $400 worth after 12 days. American immigration officers will request citizenship identification.

Convention registration fee is $1 for members, $2 for others. Banquet reservations are $7 per plate, those for the welcoming luncheon, $2. The all-day Laurentian tour costs $5, including cocktail and luncheon. Fashion show luncheon tickets are $2.

Reservation forms for hotel accommodations and the main social events are on the colored insert in this section. To be sure of another good time with ASTE, mail yours now so we can count you in.

Left from top: This illuminated cross towering above Mount Royal is a beacon for travelers and navigators. Old French architecture characterizes the Bonsecours Market district. A woodcarver carries on a French-Canadian habitant craft. Right: ASTE convention activities will center in the Mount Royal Hotel. Some of Canada's leading stores are located along St. Catherine Street. A sightseeing bus pauses before St. Joseph's Oratory, mecca for pilgrims from all over North America.

Program

17th

Semi-Annual Meeting

American Society of Tool Engineers

MOUNT ROYAL HOTEL
MONTREAL, QUEBEC

OCTOBER 27, 28, 29, 1949

Speakers


C. D. Howe


A. F. Underwood


Camillien Houde


C. R. Lewis


J. K. MacKeigan


R. P. Trowbridge


Sam Tour


J. R. Roubik


G. M. Foster


G. S. Clarke


E. L. Barker


W. A. Thomas

Thursday, October 27

8:30 A.M.

Registration Opens, *North end of Main Lobby*

(Advance registration, 7:00 P.M., Wednesday)

9:30 A.M.

Plant Tours—Canadian Car & Foundry Co., Ltd., Turcot Works; Canadian Vickers, Ltd.

10:00 A.M.—12 Noon

Scenic Films, *Ballroom, Roof*

Montreal, River of Canada, Autumn in the Laurentians, Four Seasons (Gatineau Park) *Tackle Busters, Skiing in the Laurentians.*

12 Noon

Welcoming Luncheon, *Normandie Roof*

Speakers—His Worship Camillien Houde, Mayor of Montreal, and a Montreal industrialist to be announced

2:00 P.M.

Technical Session, *Salon B, Mezzanine*

Chairman to be announced

"Mold Die Hobbing," Islyn Thomas, President, Thomas Manufacturing Corp., Newark, N. J., and Edmund W. Spitzig, Hobbing Supervisor, Newark Die Co., Newark, N. J.

"Mold Die Finishing," speaker to be announced

2:00 P.M.

Technical Session, *Salon A, Mezzanine*

Chairman, Leonard G. Singer, District Manager, Williams & Wilson, Ltd., Toronto, Ont.

"Application of Standard Tool Parts to Cut Costs," W. Arthur Thomas, Superintendent of Tool Engineering, Ford Motor Co. of Canada, Ltd., Windsor, Ont.

2:00 P.M.

Plant Tours—Dominion Engineering Works, Ltd., Lachine; Northern Electric Co., Ltd., Telephone Div., Shearer Street, and Wire and Cable Div., Lachine

8:00 P.M.

Technical Session, *Brittany Roof*

"A New Concept of Surface Measurement," Chairman, Gerald A. Rogers, Sales Engineer, Rudel Machinery Co., Ltd., Montreal

"Surface Finish Control and the Making of Master Standards," Arthur F. Underwood, Head, and Roy P. Trowbridge, Project Engineer, Mechanical Engineering Dept. 5, Research Laboratories Div., General Motors Corp., Detroit, Mich.

"Calibration of Master Roughness Standards and Their Use," Dr. Clayton R. Lewis, Staff Research Engineer, Chrysler Corp., Detroit, Mich.

Friday, October 28

9:00 A.M.

Plant Tours—RCA Victor Co., Ltd.; 9:30 A.M., Canadair, Ltd., Cartierville

9:30 A.M.

Board of **Directors Meeting**, *Brittany Roof*

10:00 A.M.

Technical **Session**, *Salon B, Mezzanine*

Chairman, A. B. Chevrier, Sales Engineer, Upton Bradeen & James, Ltd., Montreal

"Use of **Low Melting Point Alloys for Tool and Die Work**," speaker to be announced

Technical **Session**, *Salon A, Mezzanine*

Chairman, Samuel Pedvis, Sales Manager, Upton Bradeen & James, Ltd., Montreal

"**Special Purpose Machines from Standard Units**," Edgar L. Barker, President, Modern Tool Works, Ltd., Toronto, Ont.

2:00 P.M.

Plant Tours—Canadian Pacific Railway Co., Angus Shops; Montreal Locomotive Works, Ltd.

2:30 P.M.

Technical **Session**, *Salon B, Mezzanine*

"**Low Cost Tooling—Estimating and Economics**," Chairman, John R. Houghton, Assistant Superintendent, Manufacturing Methods, Telephone Div., Northern Electric Co.

"**Predesign Estimating**," G. M. Foster, Assistant Superintendent of Manufacturing Engineering, Telephone Div., Northern Electric Co., Ltd., Montreal

"**Postdesign Estimating**," George S. Clarke, Assistant Superintendent, Machine and Tool Manufacturing, Telephone Div., Northern Electric Co., Ltd., Montreal

2:30 P.M.

Technical **Session**, *Salon A, Mezzanine*

To be announced

8:00 P.M.

Technical **Session**, *Brittany Roof*

"**Hot Machining**," Chairman, James O. Horne, Sales Manager, James O. Horne & Co., Rochester, N. Y.

"**Milling Hot Workpieces**," J. R. Roubik, Lecturer in Mechanics, Marquette University and Research Dept., Kearney & Trecker Corp., Milwaukee, Wis.

"**Hot Spot Machining**," Sam Tour, Chairman of Board, Sam Tour & Co., Inc., New York City

Saturday, October 29

10:00 A.M.

Technical **Session**, *Salon D, Mezzanine*

Chairman, T. J. Tracey, Sales Engineer, Canadian General Electric Co., Ltd., Montreal

"**Statistical Quality Control**," John K. MacKeigan, Chief Inspector, Tire Div., Dunlop Tire & Rubber Goods Co., Ltd., Toronto, Ont.

Motor Tour through Laurentian Mountains
Luncheon at resort hotels

6:00—7:00 P.M.

Banquet Reception, *Ballroom Balcony and Foyer, Roof*

7:00 P.M.

Semi-Annual Dinner, *Ballroom, Roof*

Address, "Industrial Canada—Today and Tomorrow," by Clarence D. Howe, Minister of Reconstruction and Supply and Minister of Trade and Commerce, Government of Canada

Entertainment

* * *

LADIES PROGRAM

Thursday, October 27, 2:00 P.M.

Plant Tour—National Breweries, Ltd.

Friday, October 28, 9:30 A.M.

Plant Tour—Imperial Tobacco Co. of Canada, Ltd.

12 Noon—Fashion Show Luncheon, *Palm Court*

2:00 P.M.—Plant Tour, Distillers Corp., Ltd.

Technical Chairmen

National Program Chairman—F. J. Schmitt

G. A. Rogers

T. J. Tracey

J. O. Horne

L. G. Singer

A. B. Chevrier

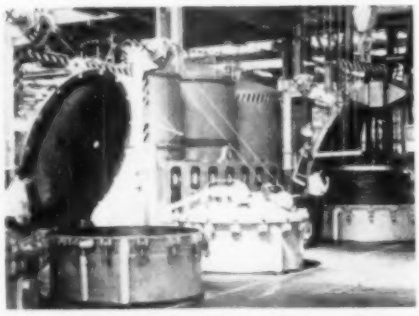
Samuel Pedvis

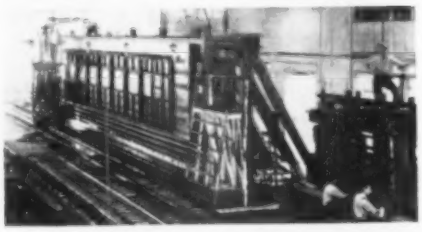
J. R. Houghton

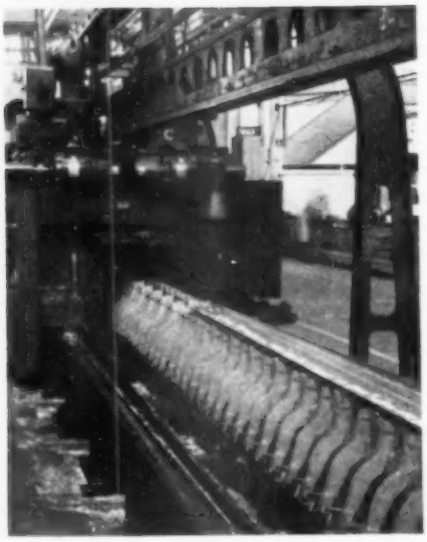
Only a Fraction of Canada's Hydroelectric Potential

10 Million Horsepower

Boosts Nation's Production, Modernizes Plants ASTE Will Visit at Montreal







WHEN INDUSTRY depended on coal-fed steam power, the Laurentian Mountains north of Montreal seemed of no commercial value. Today they are a priceless asset. Ever since the ice age they have cradled innumerable lakes at varying levels. Now sluggish deeps, now boiling rapids, the water in hundreds of rivers fed by these natural reservoirs is first stored up, then suddenly released.

Converted into hydroelectricity, this surge of energy is the motive power for more than 90 percent of Canada's production. It makes Montreal the hub of the nation's industry.

But the 10 million horsepower already harnessed is only two-fifths of the hydro potential. Capital equipment now being manufactured to further advance the country will be inspected by the ASTE convention party during tours of Montreal plants.

High Speed Paper Mill Machinery

Approximately half of Canada's horsepower capacity is developed by turbines from the Dominion Engineering Works, a pioneer in electric steam generators.

Visitors to this plant will also see enormous papermaking machines expected to break their prototypes' world speed records in producing newsprint, Canada's largest export. Roll construction is particularly interesting. A special machine drills thousands of small holes in rubber covered drying rolls. Huge lathes turn cast rolls 10 feet in diameter; carbide tools machine others of chilled cast iron.

A host of other heavy industrial products will be shown in the Dominion plant, said to house the country's greatest variety of machine tools. More than a tenth of its 1800 employees are in the engineering division.

Left from top: Power cable is dried under vacuum in these tanks at Northern Electric Co., then impregnated under pressure with a hot mineral base oil compound. A high production rubber press forming machine at Canadair, Ltd. produces multiple contour aircraft parts. One side of a railway passenger car is positioned in a vertical jig for spot welding at Canadian Car & Foundry Co. Hydraulically operated automatic clamps open and close as the cutter passes in milling 75 ST material for main spar caps of the Canadair Four. Right: A damaged ship has limped into drydock for repairs at Canadian Vickers, Ltd.

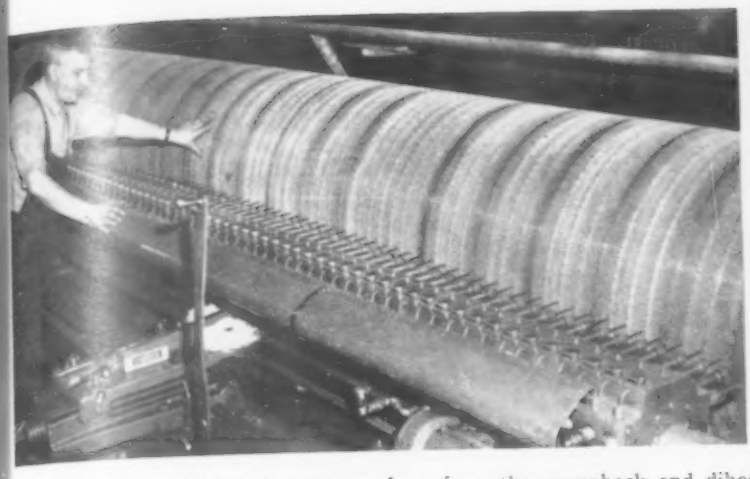
How Canada spans its vast territory will be demonstrated in trips to several builders of transportation equipment. The Turcot plant of Canadian Car & Foundry Co. will show how the side structure of a passenger car is welded. Side framing is joined by hand arc welding, side sheet sections by automatic submerged arc welding. Then a full length side sheet skin is placed against a vertical jig about 90 feet long and stretched before spot welding to the frame.

Foundry Setups for Car Wheels

In the wheel foundry, setups for producing as many as 260 chilled iron freight car wheels per day will be observed. Interest will also center around the fabrication and erection of sub-assemblies in the buildup of roomettes for modern sleeping cars.

To haul such cars Montreal Locomotive Works, Ltd., makes steam and Diesel-electric locomotives for railways in Canade, Europe, Asia and Africa.

Included in the tour of this plant will be machine, boiler, hammer, wheel and tender tank and truck shops for producing component parts. The Society group will see broad gage steam locomotives for



India and 1000 hp Diesels in process of assembly.

In the busy Angus Shops of the Canadian Pacific Railway Co., construction and maintenance of rolling stock are major operations. Powerful electric traveling cranes serve the erecting tracks and adjacent machine shop in the locomotive repair department.

Other shops repair freight and passenger cars. In the latter department complete interior finish is applied to steel car bodies received from equipment manufacturers. A number of auxiliary metal-working shops will be included in the ASTE visit.

Builds and Repairs Ships

Guides at Canadian Vickers, Ltd., will escort ASTE members around the company shipyard where vessels for Canada and foreign countries are under construction. These operations feature steel plate and sheet metal fabricating, advanced welding and furniture making.

On a floating dock of 25,000 tons capacity, built in England and towed across the Atlantic, ships are completely repaired.

The engineering division machine shop processes presses, paper machinery, ship's engines and crushers. Pressure vessels are made in the boiler shop, while distillery vessels and general coppersmithing are assigned to the process engineering division.

Swift aircraft for travel overland and overseas come off the lines at Canadair, Ltd. Fabrication includes Bliss press operations for impact extrusions and a Minster press that shapes wing tips by deep draw sheet forming. In making main landing gear trunnion fittings and spar cap end fittings, a Hydro-Tel profile machine is used. Special hydraulic clamps, an oil gear press and heated bending dies form the sweepback and dihedral on 75 ST spar caps.

Among other operations to watch along the Canadair tour are panel wiring, hydraulic controls and engine preparation, propeller checking and final assembly.

Through telephone equipment contributed by Northern Electric Co., Ltd., immediate communication is possible between remote parts of the world's third largest country.

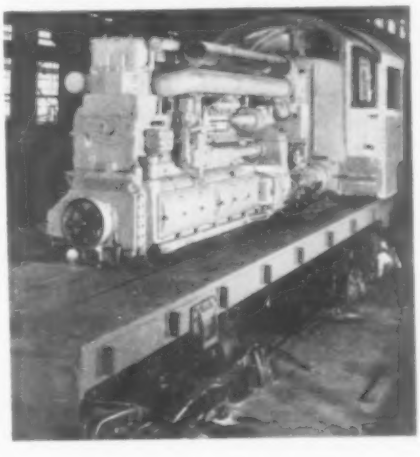
Complicated Tooling for Plastics

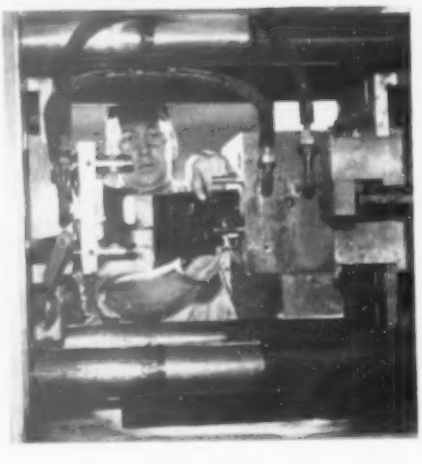
The complex tooling for fabricating telephone sets involves operations on optical and precision contour grinders, induction heating equipment, jig borers, duplicators and a liquid honing machine. Press tools, mirror finished plastic molds and the wide use of conveyors in assembly also may be studied in this plant.

High speed wire drawing, stranding, twisting, covering, insulation and reinforcing of cables will be followed intently in the wire and cable division, which processes fine filament wire thinner than a human hair to huge armor plated submarine cables for trans-oceanic communication.

Although Canada has not yet begun telecasting, RCA Victor Co., Ltd., is already making sets for customers in border cities where nearby U. S. broadcasts can be picked up. After touring the main parts of this plant, the ASTE party will see the television test setup, the radio receiver assembly lines and the record factory.

Nearly all the plants on the program make other important products which they will show in process.





Top left: Dominion Engineering Works uses multiple drills to pierce large suction couche rolls for paper-making machinery. Right, from top: A worker in the repair shops of Canadian Pacific Railway Co. contour mills a locomotive side rod. Assembly operators work on special apparatus at RCA Victor Co. A 35 ft boring mill is set up for an unusual operation at Dominion Engineering Works. Equipment at the Angus Shops of Canadian Pacific Railway Co. includes a locomotive crank pin quartering machine. A Northern Electric Co. employee removes an injection molded plastic telephone base from the 16 oz injection. A 1000 hp Diesel locomotive reaches early stages of completion in the Montreal Locomotive Works.

Host Chapter Convention Chairmen

M. A. Cote
General Chairman

T. C. Hill
Plant Tours

R. A. Byron
Registration

J. M. Rudel
Reception

H. T. Welch
Meetings, Arrangements

R. B. Seguin
Entertainment

R. C. Gillespie
Signs

J. P. Cloutier
Tickets

W. F. Stewart
Transportation

J. M. Davis
Emergency

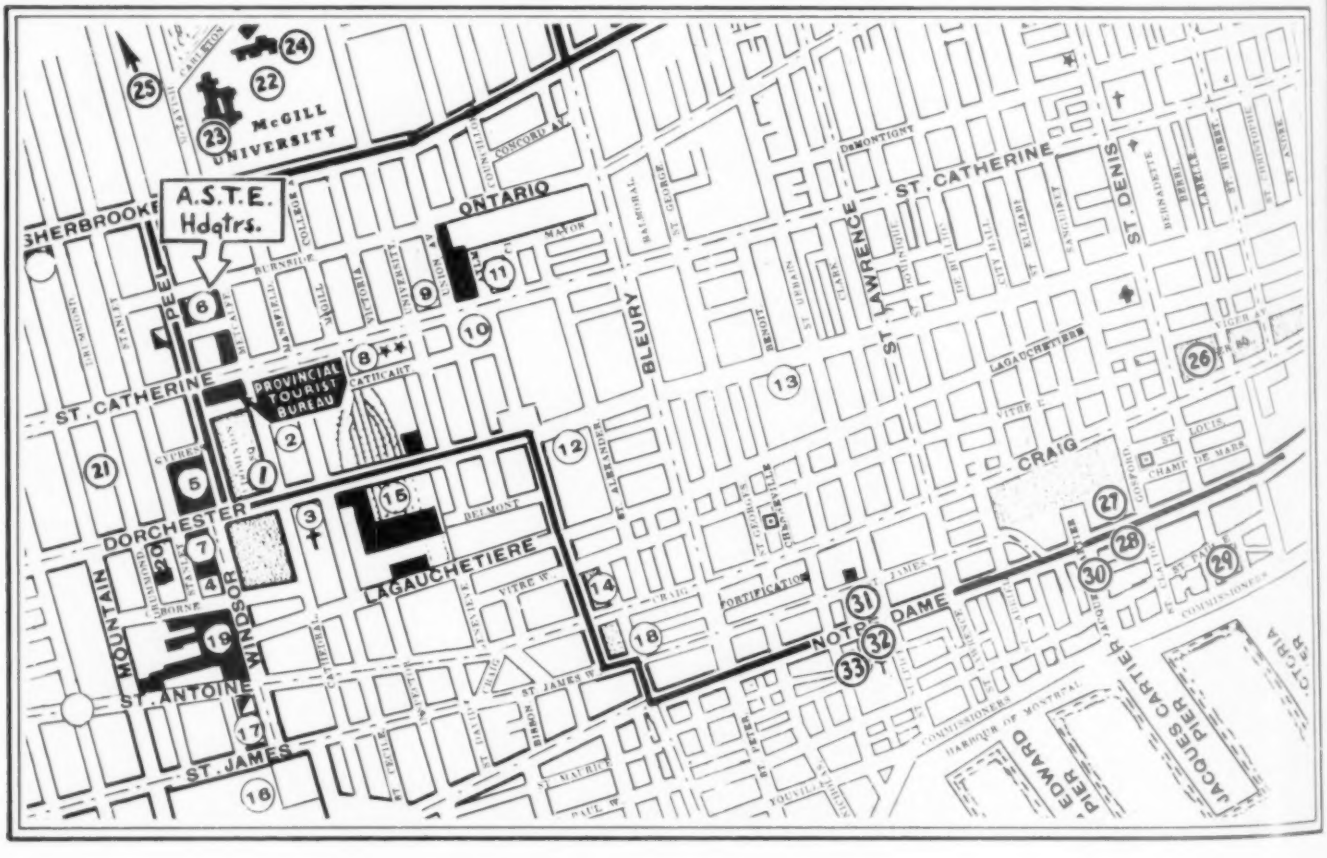
A. B. Chevrier
Banquet

T. J. Tracey
Publicity

P. E. Speer
Accommodations

Places You'll Want to See in Montreal

1 Dominion Square
2 Sun Life Building
3 St. James Cathedral
4 St. Georges Church
5 Windsor Hotel
6 Mount Royal Hotel
ASTE Headquarters
7 Laurentien Hotel
8 Theatres
9 Christ Church Cathedral
10 Phillips Square
11 St. James United Church
12 St. Patrick's Church
13 Chinatown
14 Victoria Square
15 CNR Tunnel Station
16 CNR Bonaventure Station
17 Queen's Hotel
18 Canada Steamship Lines
19 CPR Windsor Station
20 Provincial Transport
21 LaSalle Hotel
22 McGill University
23 McCord Museum
24 Redpath Museum
25 Mount Royal Park
26 Viger Square
27 City Hall
28 Chateau de Ramezay
29 Notre Dame de Bonsecours Church
30 Bon Secours Market
31 Place d'Armes
32 Notre Dame Church
33 Sulpician Seminary



North to Montreal

For the ASTE Convention, October 27, 28, 29

Only once before has ASTE visited Canada —and it was a red-letter occasion still talked about. Then you saw the English side of Canadian hospitality. This time you'll be entertained in the French manner at the "Paris of New World."

If you've saved your vacation for fall, bring the family to the convention—there'll be activities to interest everybody.

The Mount Royal Hotel will be our headquarters. It can accommodate the whole ASTE party with comfortable rooms, fine meeting and banquet facilities and six restaurants, including a smart night club and a cozy tavern for men only.

But the management needs to start counting noses so it can make plans for housing and feeding the Society smoothly and efficiently. Sharing rooms will help speed hotel service.

So—fill in the room reservation card below and mail it now. October 15 is the deadline. The next page tells you how to make reservations for the social events.

FILL IN AND MAIL THESE CARDS TODAY

MOUNT ROYAL HOTEL
Montreal, Que.
Rates per Day
Single, $5.00-$8.00 Double, two persons, $8.00-$12.00
Twin, two persons, $9.20-$12.00 Suite, $14.00-$27.00
All rooms with bath
Third person in room, $2.50 additional

Room Reservation Request

Please reserve the following accommodations for me during the ASTE convention at Montreal, Que., October 27-29:

No. Rooms	No. Persons per Room	Type Room	Rate Preferred
.....	.....	.....	.....
.....	.....	.....	.....

Arrival Date..... Time..... Departure Date..... Time.....

Name .....

Street Address .....

City..... Zone..... State.....

Reservations assigned at next available rate when requested rate not obtainable
Reserved rooms not guaranteed for morning arrival

RESERVATIONS CLOSE OCTOBER 15

Mail with remittance to:
Mr. Howard M. Windsor
Secretary to National Program Committee
American Society of Tool Engineers
10700 Puritan Avenue
Detroit 21, Michigan

By Your Montreal Hosts

You'll feel at home right away at the Montreal convention. It will open with a welcoming luncheon, Thursday noon, sponsored by the Host Chapter. The mayor of Montreal will officially welcome ASTE; an industrialist will tell something about manufacturing in Canada. You'll meet other Canadian executives and your Society officers.

From then on you'll be busy attending technical sessions and plant tours and seeing the town. Saturday the entire convention party will motor through the Laurentian Mountains, lunching at one of three selected resort hotels.

Closing event will be the banquet that evening. Before dinner there will be a reception. A distinguished engineer who is Minister of Reconstruction and Supply and Minister of Trade and Commerce for the Government of Canada will be the after dinner speaker. An entertaining floor show will wind up the 17th Semi-Annual Meeting. (This may be your last opportunity to attend a semi-annual ASTE convention. Tentative future plans call for annual conventions and regional meetings.)

To be sure you and your guests have places at the luncheon and banquet, order your tickets today on the perforated form below.

FIRST CLASS
Permit No. 10782
(Sec. 510 P L & R)
DETROIT, MICH.

BUSINESS REPLY CARD
No Postage Stamp Necessary If Mailed in the United States

MR. HOWARD M. WINDSOR
Secretary to National Program Committee
AMERICAN SOCIETY OF TOOL ENGINEERS
10700 PURITAN AVENUE
DETROIT 21, MICHIGAN

FILL IN AND MAIL THESE CARDS TODAY

Banquet and/or Luncheon Ticket Order

Please make the following reservations for me:

Total

..... **tickets for Welcoming Luncheon, Oct. 27 @ $2.00 $**.....

..... **tickets for Semi-Annual Dinner, Oct. 29 @ 7.00** .....

Enclosed is ☐ check ☐ money order in the amount of $..... **in payment of tickets for above events at the ASTE Semi-Annual Meeting at Montreal.**

Name .....

Street Address .....

City..... **Zone**..... **State**.....

ADVANCE RESERVATIONS CLOSE OCTOBER 20
Do not send currency. Please make checks and money orders payable to Society only.

B52 Committee To Hold Organization Meeting

Detroit, Mich.—The ASA Sectional Committee B52—Classification of Materials for Tools, Fixtures and Gages—will meet September 23 at the Engineering Society of Detroit, L. B. Bellamy, ASTE national standards chairman, has announced.

Sponsored by ASTE through the American Standards Association, this project represents the Society's first active participation in standardization since 1941 when the undertaking was initiated.

At 10 a.m. Mr. Bellamy will call the meeting to order, followed by R. B. Douglas, Society president, who will give an introductory address.

A. M. Swigert, vice-president of Universal Products Co., Dearborn, Mich., will discuss "Objectives and Advantages of Tool Steel Standardization" and Dr. John A. Gaillard, secretary of the ASA Mechanical Standards Committee, will describe "Method of Work of Sectional Committees Under the Procedures of ASA."

Will Organize Activities

After electing officers the committee will plan its work, considering past activities, objectives, formulation of scope of undertaking, organization of sub-committees and order in which sections of work should be attempted.

ASTE representatives are: E. E. Griffiths, consulting manufacturing engineer, Parent and International Co., Headquarters Manufacturing Div., Westinghouse Electric Corp., Pittsburgh, Pa.; William Moreland, production manager, Greenlee Bros. & Co., Rockford, Ill.; W. A. Thomas, superintendent of tool engineering, Ford Motor Co. of Canada, Ltd., Windsor, Ont.; G. S. Wilcox, Jr., assistant factory manager, Plymouth Div., Chrysler Corp., Detroit; Mr. Bellamy, district manager, Sterling Grinding Wheel Co., Detroit; and Mr. Swigert.

Many Fields Represented

Other participating organizations and their representatives are: American Society for Metals, Dr. Taylor Lyman, editor, Metals Handbook, ASM, Cleveland, Ohio; Society of Automotive Engineers, L. A. Danse, supervisor, materials and processes, production engineering section, General Motors Corp., Detroit.

National Bureau of Standards, T. G. Digges, U. S. Department of Commerce, Washington, D. C.; American Iron & Steel Institute, D. J. Giles, vice-president, Latrobe Electric Steel Co., Latrobe, Pa., and M. E. Cummings, assistant to the president, Crucible Steel Co. of America, New York City.

American Standards Association, Telephone Group, C. T. Prendergast, Western Electric Co., Chicago, Ill., and alternate, J. R. Townsend, Bell Telephone Laboratories, Murray Hill, N. J.

National Machine Tool Builders' Association, F. O. Hoagland, master mechanic, Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn., and alternate, A. G. Knight, chief engineer, Hendy Machine Co., Torrington, Conn.; Pressed Metal Institute, Ray Peterson, president, Peterson Engineering Co., Toledo, Ohio, and Bureau of Ships, Code 350, Navy Department, Washington, D. C.

Reactivation of this committee, Standards Chairman Bellamy states, will establish the Society with other leading standardization organizations and satisfy a long felt need of the membership.

Montreal Is Nearer Than You Think

Here are traveling times and distances from key ASTE cities to the fall convention location. Plan your trip accordingly.

To Montreal from:	By Air Hrs.	By Air Mins.	By Train Hrs.	By Train Mins.	By Auto Miles
Atlanta, Ga.	9	00	37	35	1241
Boston, Mass.	2	14	11	30	326
Buffalo, N. Y.	4	15	15	15	387
Chicago, Ill.	4	20	21	50	856
Cleveland, Ohio	2	25	18	00	577
Denver, Colo.	8	25	39	30	1875
Detroit, Mich.	4	00	15	30	587
Hartford, Conn.	2	57	9	7	338
Houston, Tex.	13	40	47	30	1888
Kansas City, Mo.	8	25	33	30	1337
Los Angeles, Calif.	12	20	66	00	2955
Minneapolis, Minn.	8	10	32	20	1176
New York City	2	10	11	50	386
Philadelphia, Pa.	3	50	13	52	468
Portland, Me.	3	44	9	25	275
Rochester, N. Y.	4	38	11	00	316
Seattle, Wash.	18	35	72	45	2783
Toronto, Ont.	1	40	8	00	358
Washington, D. C.	5	35	16	5	619

Amber Brunson, past chairman of Kansas City chapter, relaxes in the stern of his boat while H. Robert Brown (left), another former chairman, waits hopefully for a crappie to bite, during weekend fishing trip on Lake of the Ozarks.

Kansas City Fishermen Spend Weekend in Ozarks

Kansas City, Mo.—A group of 40 Kansas City tool engineers with their families and friends spent an enjoyable weekend, July 8-10, at Osage Beach on the Lake of the Ozarks.

With Past Chairman Amber Brunson acting as guide and boat towing specialist, the enthusiastic anglers caught good strings of crappie.

Other activities included an evening ride on an excursion boat and swimming.

Other News in This Issue

Chapter listings include member as well as meeting news.

Crack horseshoe pitchers at Boston chapter outing make decision difficult on this play. From left: H. C. Roth of L. S. Starrett Co., Athol, a guest; L. H. Laughton and R. G. Roth of Worcester chapter, and J. N. MacAllister, another guest from L. S. Starrett Co.

Boston Outing Gives 200 Day of Golf and Games

Boston, Mass.—Favored by a clear sunny day, approximately 200 members and guests of Boston chapter enjoyed a summer outing recently at Tyngsboro Country Club, Tyngsboro, Mass.

Golf was the main attraction, with three games of softball, lively horseshoe and shuffleboard contests for variety.

A buffet luncheon was available during the day. After the sports program had been run off, sharpened appetites were appeased with a roast beef dinner served in an open pine grove.

Golf and softball winners were awarded prizes and everyone present received an attendance prize. In the evening several singing and dancing acts were presented.

Walter F. Jones, arrangements chairman, and his committee, were in charge of the successful affair.

Yost Honored at Outing

Evansville, Ind.—On July 11 some 80 members and guests attended Evansville chapter's fourth annual stag picnic at the Servel, Inc. picnic grounds, owned and operated by company employees.

Highlights of the program included presentation of a past chairman pin to Clyde Yost by Howard McMillen, national finance chairman, and drawings for attendance prizes.

Roy Ackerman, program chairman, was in charge of arrangements. Walter Schneider, Walter Stippler, Charles Thuman, Roman Wannemuehler, Paul Wetzel, Walter Lochmueller, Arthur Ullman, Clyde Yost, Harry Ferguson and Bernard Pampe, of the chapter executive committee, assisted Mr. Ackerman with the serving and entertainment.

Acme Briefs Name

Buffalo, N. Y.—The Acme Pattern and Machine Co. is now known as Acme-Winter Corp., O. W. Winter, company president, has announced.

Mr. Winter, a former president of ASTE, indicates that new products and developments are to be released by the 44-year-old Buffalo firm.

A group of alumni from Wilbur Wright Vocational School, Detroit, forms a second student section of Detroit chapter. C. D. Lowell (left) and S. C. Phillips (right), instructors at the school and ASTE members, were instrumental in organizing the section.

Detroit Chapter Forms Second Student Section

Detroit, Mich.—Detroit chapter has established its second student section among a group of 14 alumni of Wilbur Wright Vocational High School.

S. C. Phillips, a faculty member, did the preliminary organizing under the direction of C. D. Lowell, head of the drafting department and evening school principal. Both instructors are members of Detroit chapter.

Mr. Lowell, presiding at the recent organization meeting held at the school, introduced several chapter officers.

M. O. Cox, chairman, spoke on "What Is the ASTE?" C. M. Smillie, first vice-chairman, described "Benefits of Membership in ASTE" and G. F. Bush, education chairman, named "Qualifications for Membership in ASTE."

"Operation of a Student Section" was outlined by Ernest Ladinig, chairman of the Detroit College of Applied Science section.

At the conclusion of the formal talks, the meeting was opened for questions and discussion. The majority of the student group submitted applications for membership. Election of section officers will be held at the first fall meeting.

After the meeting refreshments were served by the parent chapter.

Kallemeier Heads Annual Stag Picnic

St. Louis, Mo.—One of the most enjoyable outings ever sponsored by St. Louis chapter took place July 9 at Tamme's Grove, Fenton. R. C. Kallemeier was chairman of the stag picnic.

The tool engineers tried their hands at softball, corkball, swimming, horseshoes, cards and other table games. Each member was awarded an attendance prize, plus a chance at the traditional grab bag.

Address of the day was a transcription by "Senator Johnson from Arkansas," played repeatedly.

Howard McMillen, ASTE national finance chairman, presents a past chairman pin to Clyde Yost (left), immediate past chairman of Evansville chapter, at chapter's fourth annual stag picnic.

Golf Tournament Leads Field Day Events

St. Catharines, Ont.—Niagara District tool engineers got together recently for their annual field day, at Chippewa Golf Course, Niagara Falls, Ont.

Nearly 150 people enjoyed a full day and evening of outdoor events. Ninety entered the golf tournament, prizes being awarded to D. Colbuk for low net, S. Wilsher, low gross, with a special award to D. Mackintosh for high gross. W. Henderson won at bowling and A. Randall and J. Saxton swept the field in horseshoe pitching.

Supper was served in the clubhouse, followed by a drawing of attendance prizes. J. Little, who obtained the prizes, awarded them to more than 60 winners.

Norman Coleman, chapter chairman, commented on the record attendance which brought visitors from Buffalo and Rochester, N. Y., Toronto and Hamilton, Ont. In closing he thanked Entertainment Chairman Albert Clarkson and his committee for their splendid handling of the event.

Takes Southern Post

Salem, Va.—Leo J. Pantas, formerly manager of the Buffalo, N. Y., plant of Yale & Towne Mfg. Co., has been transferred to the Salem plant as manager.

Mr. Pantas, a member of Buffalo-Niagara Frontier chapter, is the third graduate of the Yale & Towne apprentice school to become plant manager.

Student Lecture Features Actual Design Problem

Detroit, Mich.—R. C. Heinmiller, chief engineer, LeMaire Tool & Mfg. Co., addressed the final meeting of the season of the Detroit College of Applied Science section of Detroit chapter.

Speaking on "Machine Design," he displayed blueprints of an actual problem in machining a grey iron flywheel housing for an automotive producer.

Mr. Heinmiller led the students through the process of designing a machine to do the job. Dwelling in detail on fixture design, he pointed out factors which must be considered.

After the customer's final approval is obtained, he added, the machine is designed around the tool and the fixture. The speaker stressed benefits of utilizing standard components on the machine wherever possible.

In conclusion Mr. Heinmiller emphasized advantages and drawbacks of a career in machine design. A stimulating question period followed his talk.

After the technical program, refreshments were served and a film was shown. Ernest Ladinig, section chairman, presided at the meeting.

ASTE Show Moved To Philadelphia

Detroit, Mich.—The 1950 ASTE Exposition will be held the week of April 10 at Convention Hall, Philadelphia, according to an announcement by Harry E. Conrad, executive secretary.

Originally scheduled for the Public Auditorium at Cleveland, Ohio, March 20-24, the show is being moved to the Pennsylvania industrial center because of conditions which have since developed.

These changes in time and location are expected to benefit both exhibitors and visitors.

My apple trees will never get across
And eat the cones under his pines, I tell him.
He only says, "Good fences make good neighbors."

Robert Frost—*Mending Wall*

Fond du Lac Fishermen Compete at Green Lake

Fond du Lac, Wis.—Approximately 50 members and guests of Fond du Lac chapter sailed July 30 from Norton Brothers Dock, Green Lake, Wis., for an afternoon fishing stag. All were equipped with tackle to compete in catching the largest fish, most fish and smallest fish.

The party left in three large launches towing five smaller boats supplied with minnows and worms. Arriving at the fishing holes, the sportsmen transferred to the smaller craft and the contest was on.

"Butch" Faith, Fred Leicht and Dick Leicht kept the crowd in good humor with iced beverages.

Late in the afternoon the launches took the group to "Sugar Loaf" beach for a shore lunch and the awarding of prizes before the return trip.

Tells How Branch Plant Assembles Automobiles

Los Angeles, Calif.—Problems encountered in building automobiles far from the parent plant were discussed by Martin La Ross, production and tool engineer of Buick-Oldsmobile-Pontiac Assembly Div. of General Motors Corp., South Gate, before 154 members and guests attending a Los Angeles chapter meeting, July 14, at Roger Young Auditorium.

By using coordinated parts and utilizing existing holes in tooling and indexing, Mr. La Ross explained, bodies are built up in a series of weld assemblies at the rate of 55 per hour.

Continuing, he described how subassemblies for three models are assembled into complete vehicles in one plant.

Almand with Norton

A release from Atlanta chapter, appearing in the July issue, identified Zack Almand, a technical speaker, as associated with Carborundum Co. Mr. Almand has been an abrasive engineer for Norton Co. since 1940, according to an executive of that company.

Situations Wanted

LAYOUT MAN—43, experienced in truck manufacture—steering geometry, installation of mechanical equipment, frame construction, body detailing, body hardware, die casting dies, plastics applications. Developed special fuel tank for inside-of-frame location; motor and transmission brackets for mounting on rubber. Have thorough knowledge of tool design standards and practices. Married, references on request. Address replies to Box 177, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

MECHANICAL ENGINEER—26, interested primarily in machine design. Three years' naval experience in hydraulic maintenance and some shop background. Would like further shop work to become more familiar with tools and machines. Have B.S. in M.E. Prefer connection with stable firm in North Central States. Detailed qualifications upon request. Please address Box 174, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

PRODUCTION OR COST ESTIMATING ENGINEER—23, aggressive, desires junior position in these fields. Production engineering graduate from Detroit College of Applied Science. Single, free to travel. Please write to Box 176, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

SALES ENGINEER—District representative for special machines and tools for Michigan industry. Wide experience in grinding and honing; well acquainted in auto industry. Fifteen years' experience. Can furnish excellent references. Reply to Box 175, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

This group from Ford Motor Co. attended Detroit chapter's closing meeting of the season. Men in front row are new members.

OUR SOCIETY

By H. E. Conrad

It's most pleasing to hear the many favorable comments on the Handbook. More gratifying to me, however, is the fact that over $27,000.00 in cold cash was laid on the barrelhead, so to speak, before the book was published. This tremendous display of confidence in the Society by its members is certainly significant of the power of our strength and integrity.

Plans for the Montreal convention are progressing satisfactorily. As is usual in planning a function of this proportion, there are always the last minute upsets but, so far, nothing serious has gone amiss.

The elected officers are planning their meeting for August 20-21 here in Detroit. I only hope all the committee reports are in by that time. After the officers' meeting comes the Finance Committee meeting in September and, by that time, everything should be in readiness for the Board of Directors meeting at the Montreal convention.

Show To Be in Philadelphia

A change has been made in our original plans to hold the 1950 Industrial Exposition in Cleveland, Ohio. Instead, the exposition will be held the week of April 10, 1950, in Convention Hall, Philadelphia, Pennsylvania. Certain factors beyond our control in Cleveland dictated this change in the best interest of our exhibitors as well as the Society. So, the next big ASTE show is going to be in "Philadelphia—the workshop of the world."

Preliminary contacts with Emil Kitzman, chairman of the Philadelphia chapter, and Roy Paulsen and Kenneth Riddle, his first and second vice-chairmen, assure us all a hearty welcome and an outstanding convention loaded with excellent plant tours and splendid technical sessions. Advance reaction on the show is also most encouraging.

Office Romances

The moon must be slightly off its regular orbit. This is definitely indicated by the fact that June is coming in August this year—at least insofar as the headquarters office is concerned. There will be two marriages this month involving three of the headquarters staff. Miss Maxsine Erickson, who has been on the staff since December 1942 and whom most every ASTEr knows, winds up her many romances on August 20. The lucky guy is George Bobbish (an ASTE member in good standing). The other two involved in this June in August business are Margaret Howes and "Nick" Carter. Most of you remember Margaret as the girl who handled our housing reservations at the 1948 Exposition. "Nick" is our bookkeeper and, incidentally, didn't get a chance to turn many pages before Margaret turned his head and it wasn't long after that before the die was cast and August 14 is to be the day.

Utica Daily Press photo

E. J. Masucci (right), chairman of Mohawk Valley chapter, introduces J. L. Schwab (center), New England divisional manager, Methods Engineering Council, Bridgeport, Conn., and E. B. Wallin, superintendent of methods and standards, Remington Arms Co., Ilion, N. Y., following Mr. Schwab's recent lecture before the chapter.

Frances Watson, Frank Wilson's girl Friday on Handbook activity, is expected back in the office on August 15 after a rather rugged vacation, having spent all but two days in the hospital undergoing emergency surgery. We've missed her and are glad she came through in such a splendid manner. The Handbook activity needs her just to handle the rush of orders.

September starts our chapter activities and, from what has been reported, it looks as though all chapters are getting off to a good start. Let's everybody put our shoulders to the wheel and keep things moving in the right direction. Remember, everybody, "get one" and win: (1) get a new member; (2) get a Handbook; (3) get a building fund certificate (done). How about finishing the others?

B. D. Marshall (left) of Chevrolet-Detroit Forge Div., General Motors Corp., describes drop forging technique for Detroit chapter members. Albert Hazzard (right) of the Michigan Department of Conservation explains problems encountered in developing trout fishing waters in the state.

Coming Meetings

CHICAGO—September 13, Western Society of Engineers, 84 E. Randolph St. Speaker from Ford Motor Co. Subject: "From Iron Ore to Motive Power."

CLEVELAND—September. Trip to Detroit Arsenal to see new General Patton tank.

MONTREAL—October 27, 28, 29, Mount Royal Hotel. ASTE 17th Semi-Annual Meeting. October 28, Semi-Annual Meeting, Board of Directors.

PHILADELPHIA—September, Broadwood Hotel. Executives Night.

WINDSOR—September 12, Prince Edward Hotel. Speaker: Wallace H. Clark, director of industrial relations, Ford Motor Co. of Canada, Ltd., Windsor, Ont. Subject: "Human Relations in Industry."

Auto Executive Relates Advances in Forging

Detroit, Mich.—B. D. Marshall, plant manager of Chevrolet-Detroit Forge Div. of General Motors Corp., delivered the closing lecture of the season at Detroit chapter.

Mr. Marshall traced the development of drop forge technique from 1911 when he joined Packard Motor Co. as an apprentice die sinker. At that time the die room foreman was the tool engineer of the forge plant. This was a hit-or-miss proposition as a great deal of the design was left to the die sinker.

The speaker gave the group extensive information on the machinery now used in diemaking and on the coordination required between forge plants, machining plants and product design in order to produce parts economically.

Prior to the technical session Albert Hazzard, Ph.D., spoke on "Developing Trout Fishing in Michigan's Lakes and Streams." Mr. Hazzard has charge of the Fisheries Institute of Ann Arbor, directed by the State Department of Conservation.

In explaining the Conservation Department's program for developing trout fishing waters throughout the state, he called attention to the problem created by Detroit with its large population in the southeast corner of Michigan.

McKinney Tops Golfers With Low Net of 79

Chicago, Ill.—Some 40 members of Chicago chapter swung their clubs at an all-day golf tournament and outing, July 17, at Woodridge Country Club in Lisle.

With three heavily wooded holes, four on creeks, and five par five, the Blind Bogey players found an interesting and difficult course.

Robert McKinney won first prize, a dozen golf balls and a putter, with a score of 99 and a handicap of 20, giving him a net of 79. R. Brooks was awarded a putter as second prize.

Other winners and their respective takes were: R. Bolstad, third, a dozen golf balls; T. Mummery, fourth, six golf balls; R. Gustison, fifth; T. Wittek, D. Bruss and H. V. Loeppert, sixth; C. Anderson and T. Seaver, seventh; and R. R. Wright, Glen Haley, George Shmittker, Harry Walker, B. Pichall, eighth.

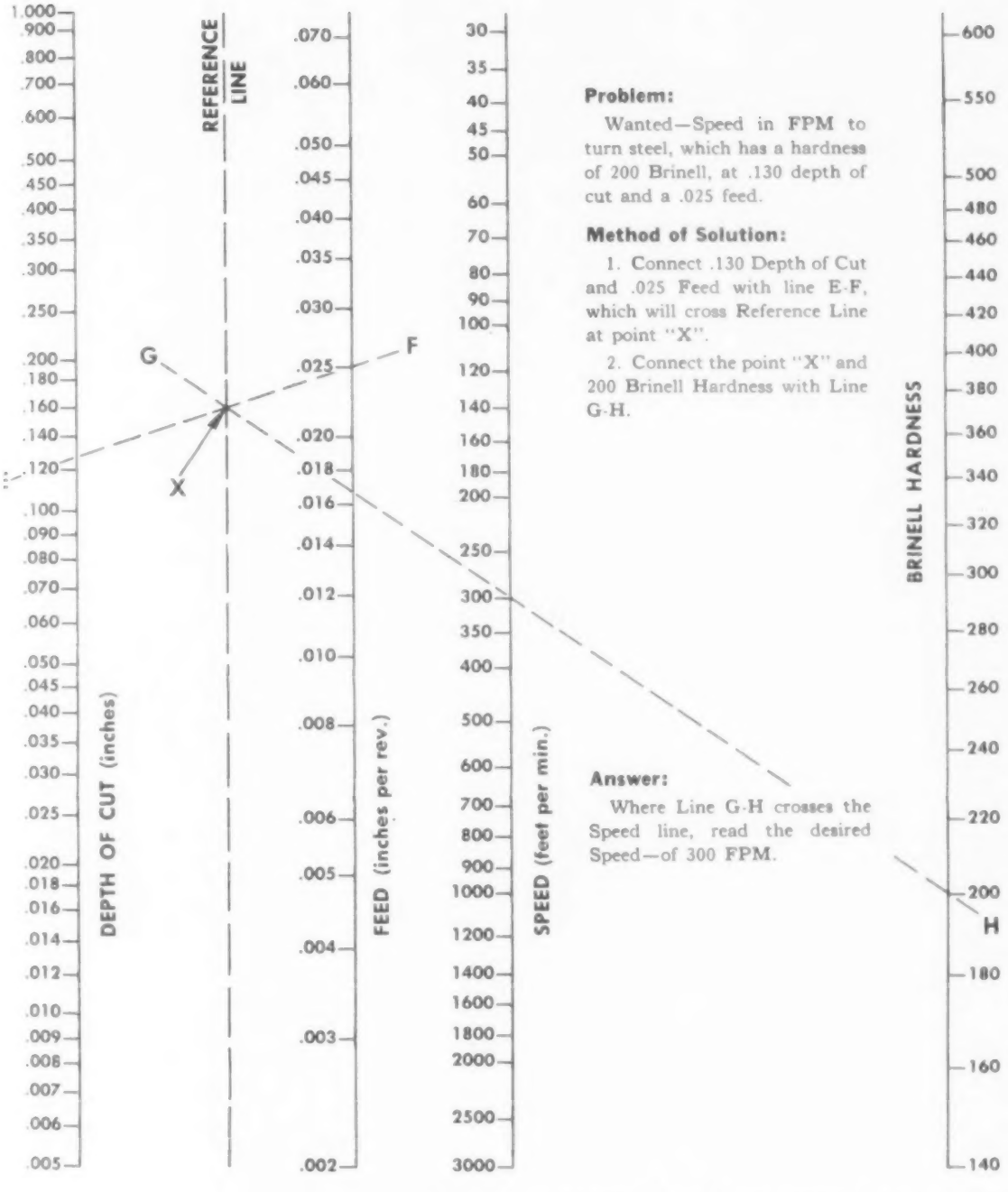
After the game dinner was served, followed by card games and a putting contest. Mr. McKinney carried off top honors in the latter event.

Transfers to Los Alamos

Los Angeles, Calif.—Joseph A. Parks of the experimental engineering department, University of California, is being transferred to an experimental shop at Los Alamos, N. M., according to a recent announcement.

An active member of Los Angeles chapter for seven years, Mr. Parks heads the industrial relations committee and has served as chapter secretary for three years.

Speeds for Machining Steel with Carbide Dies



Problem:

Wanted—Speed in FPM to turn steel, which has a hardness of 200 Brinell, at .130 depth of cut and a .025 feed.

Method of Solution:

1. Connect .130 Depth of Cut and .025 Feed with line E-F, which will cross Reference Line at point "X".

2. Connect the point "X" and 200 Brinell Hardness with Line G-H.

Answer:

Where Line G-H crosses the Speed line, read the desired Speed—of 300 FPM.

Reprinted from the Carboloy Tool Manual. Courtesy Carboloy Company

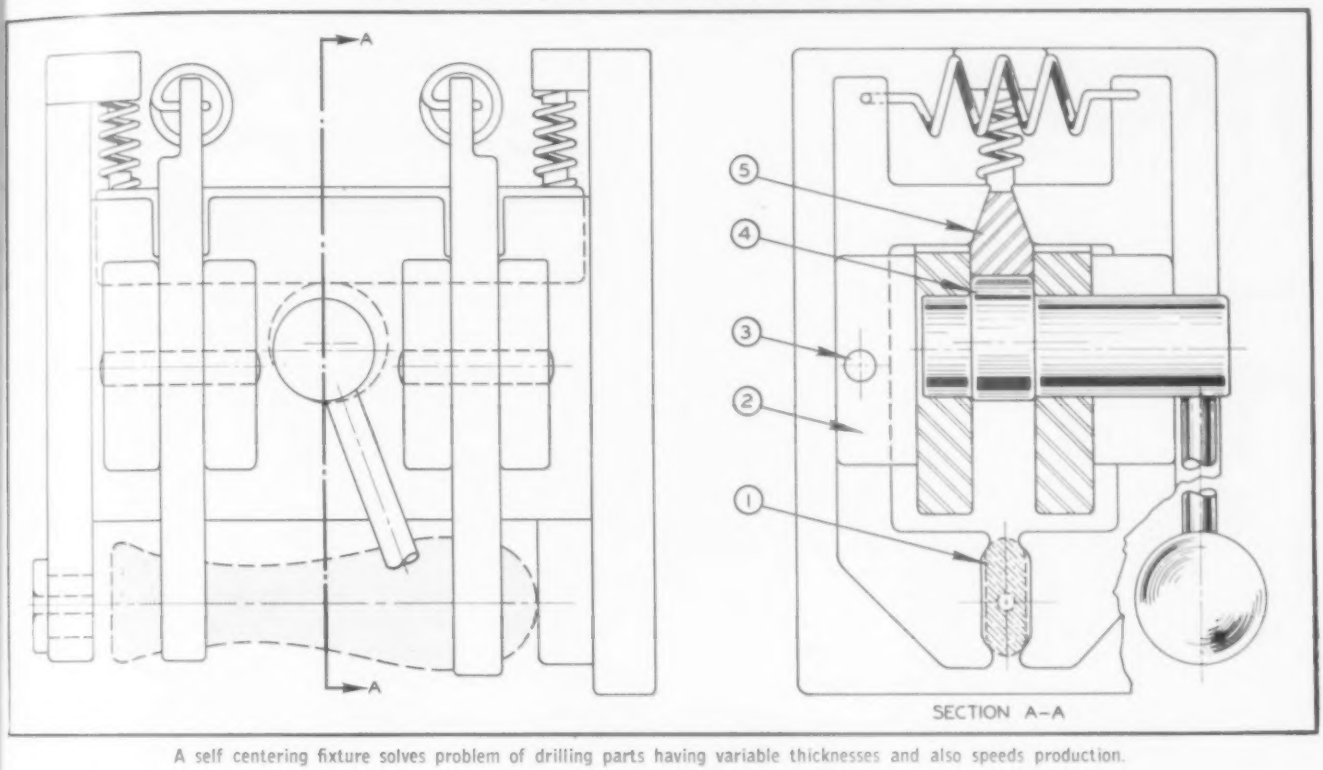
Table of Draft Angles

Depth	1/32	1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32	3/8	13/32	7/16	15/32	1/2	17/32	9/16	19/32	5/8	21/32	11/16	23/32	3/4	25/32	13/16	27/32	7/8	29/32	15/16	31/33	1	Depth
½°	.0003	.0005	.0008	.0011	.0014	.0016	.0019	.0022	.0025	.0027	.003	.0033	.0035	.0038	.0041	.0044	.0046	.0049	.0052	.0055	.0057	.006	.0063	.0065	.0068	.0071	.0074	.0076	.0079	.0082	.0085	.0087	½°
1°	.0005	.0011	.0017	.0022	.0028	.0033	.0039	.0043	.005	.0055	.006	.0066	.007	.0077	.008	.0088	.009	.0099	.010	.011	.011	.012	.013	.013	.014	.014	.015	.015	.016	.017	.017	.0175	1°
2°	.001	.002	.003	.004	.005	.006	.008	.009	.010	.011	.012	.013	.014	.015	.016	.018	.019	.020	.021	.022	.023	.024	.025	.027	.028	.029	.030	.031	.032	.033	.034	.035	2°
3°	.0016	.0033	.0049	.0066	.008	.0098	.011	.013	.014	.016	.018	.020	.021	.023	.024	.026	.028	.030	.031	.033	.035	.036	.038	.039	.040	.043	.045	.046	.048	.050	.051	.052	3°
4°	.002	.004	.006	.009	.011	.013	.015	.018	.020	.022	.024	.026	.028	.031	.033	.035	.037	.039	.042	.044	.046	.048	.050	.053	.055	.057	.059	.061	.063	.066	.068	.070	4°
5°	.0027	.0055	.008	.0109	.014	.016	.019	.022	.024	.027	.030	.033	.035	.038	.041	.044	.046	.049	.052	.055	.057	.060	.063	.066	.068	.071	.074	.077	.079	.082	.084	.087	5°
6°	.003	.007	.010	.013	.016	.019	.023	.026	.030	.033	.036	.039	.043	.046	.049	.053	.056	.059	.062	.066	.069	.072	.075	.079	.081	.085	.089	.092	.095	.098	.101	.105	6°
7°	.0038	.0077	.0115	.015	.019	.023	.027	.031	.034	.038	.042	.046	.050	.054	.058	.061	.065	.069	.073	.077	.082	.085	.088	.092	.096	.100	.104	.107	.111	.115	.119	.123	7°
8°	.004	.009	.013	.018	.022	.027	.031	.035	.040	.044	.049	.053	.057	.062	.066	.071	.075	.079	.084	.088	.092	.096	.101	.106	.110	.115	.119	.123	.128	.132	.137	.141	8°
9°	.005	.010	.015	.020	.025	.030	.035	.040	.045	.050	.055	.060	.064	.069	.074	.079	.084	.088	.094	.100	.104	.109	.114	.119	.124	.129	.134	.139	.144	.149	.153	.158	9°
10°	.0055	.011	.0165	.022	.027	.033	.039	.044	.049	.055	.061	.066	.071	.077	.083	.088	.093	.099	.105	.110	.115	.121	.126	.132	.137	.143	.149	.154	.159	.165	.170	.176	10°
11°	.006	.012	.018	.024	.030	.036	.042	.049	.055	.061	.067	.073	.079	.085	.091	.097	.103	.109	.115	.120	.127	.133	.139	.146	.152	.158	.163	.171	.176	.182	.188	.194	11°
12°	.0066	.013	.020	.027	.033	.040	.047	.053	.060	.066	.073	.080	.086	.093	.100	.106	.113	.120	.127	.133	.140	.147	.153	.159	.166	.173	.180	.186	.193	.200	.206	.213	12°
15°	.008	.017	.025	.033	.042	.050	.059	.067	.075	.084	.092	.100	.108	.117	.126	.134	.142	.151	.159	.167	.176	.183	.193	.201	.209	.218	.226	.234	.243	.251	.260	.268	15°
20°	.011	.023	.034	.045	.057	.068	.080	.091	.102	.114	.125	.136	.148	.159	.171	.182	.193	.205	.216	.227	.239	.250	.261	.273	.284	.296	.307	.318	.329	.341	.353	.364	20°
25°	.014	.029	.044	.058	.073	.087	.102	.117	.131	.146	.160	.175	.189	.204	.219	.233	.247	.262	.277	.291	.306	.321	.335	.350	.364	.379	.393	.408	.422	.437	.452	.466	25°
30°	.018	.036	.054	.072	.089	.108	.126	.144	.162	.180	.197	.217	.234	.253	.270	.289	.306	.325	.343	.361	.379	.397	.415	.433	.451	.469	.487	.505	.523	.541	.559	.577	30°

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Drill Fixture for Odd-Contour Handle



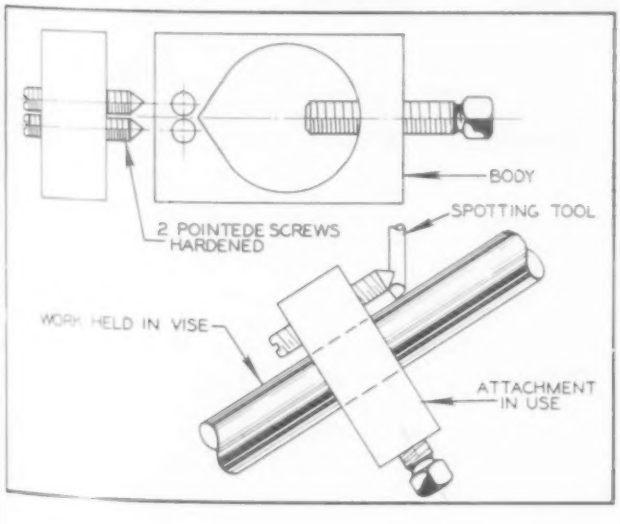
A self centering fixture solves problem of drilling parts having variable thicknesses and also speeds production.

When drilling a hole in the end of a special handle, difficulties arose because thickness of the part varied slightly. The problem, then, was to incorporate suitable rest pads to locate the part in the fixture. The problem was solved by the fixture shown, which not only located the hole true in the handle, but speeded production because of the handy locking mechanism. The part (1) is located between jaws in the lever arms (2), which pivot on the pins (3). The eccentric shaft (4) pushes the wedge (5) which causes the lever arms to lock the handle in proper position.

Ingvar Okerfors
Peoria, Ill.

Attachment for Drilling Angular Holes

The attachment illustrated serves to start angular holes in round shafts, a job ordinarily made difficult due to creep of the drill. The body of the tool is a piece of flat steel, drilled out to suit the diameter of the shaft, "veed" on one side and tapped for a tightening screw. Two pointed screws, hardened and set as closely together as possible, complete the device.



The spotting tool can be an old drill, preferably with most of the flute gone since the main consideration is to have a plain cylindrical surface bearing against the pointed screws. The work piece is held in a vise, or by other convenient means, at the desired angle. The attachment is then tightened so that the Vee formed by the pointed screws is central. If necessary, the screws may be adjusted to properly align the spotting tool.

After the hole is spotted, the attachment is slid out of the way, when a drill will easily follow the spotted hole. Almost any angle is possible and practically any size drill can be used after spotting.

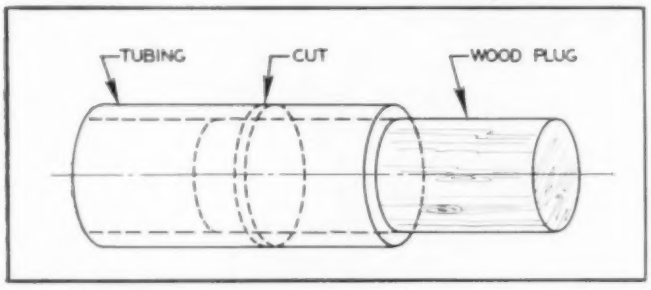
H. Moore
Hamilton, Ontario

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

To Cut Thin Tubing

To cut thin tubing in a vise without its collapsing, insert a wooden plug, as shown, and cut off with a hacksaw or other means. This method also works nicely when cutting off in a lathe. In that case, the plug can be held in the tailstock spindle and will serve to retain the cut-off portion as well as to prevent collapse.

Federico Strasser
Santiago de Chile



A wooden plug, inserted in thin tubing will permit cutting off without collapsing the tube.

Gadget Editor,
The Tool Engineer:
With regard to the Gadget titled "To Preserve Layout Lines", in issue of May 1949, it was suggested to machine or shape a piece with the layout lines facing toward the cut. It seems that with the part in this position visibility would be extremely difficult and the safety hazard would tend to increase, because in effect the operator would be working in between the machine column and the workpiece.

A commonly used shop method for shaping work that has been laid out with scribed lines is the belevelled edge method. This procedure is used when shaping irregular contours, such as encountered on die sections for blanking dies. The work is first rough shaped keeping as close to the layout line as possible without permitting the cut to break into the layout line.

The next step is to file a bevel on the layout edge, splitting the layout line in half. The finish shaping cut can now be made with the operator watching the bevel and guiding the tool to produce a feather edge. To finish the work all that is necessary is to file or grind off a few thousandths of an inch to remove the tool marks.

Sincerely yours,
H. T. Staunton, Indianapolis, Ind.

While Mr. Staunton's point is valid enough from the safety angle, the undersigned has rough milled or shaped hundreds of form tools, punches and similar parts with the cut against the layout lines, and without being conscious of inconvenience or danger. As a matter of fact, it is the preferred procedure when roughing form tools close to the line, and danger from flying chips is reduced, if anything, since chips fly away from the operator rather than toward him.

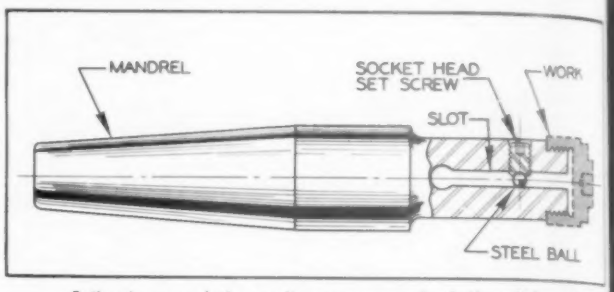
There is some inconvenience when shaping, but practically none when milling since then there is little if any obstruction to visibility. The operator sits in conventional position with regard to table feed, vertical and cross-feed handles and has practically unobstructed view of the lines. It can be compared to slotting against scribed lines, when the lines are naturally against the cut.

This comment does not rebut the method suggested by Mr. Staunton, which is accepted practise in many tool and die shops and which, in most cases, is entirely practical. In view, of long experience with this class of work, however, the writer must also support Mr. Strasser's version of cutting against the scribed lines. Anyway, we are frankly pleased with Mr. Staunton's version and cordially invite all readers to criticise our Gadgets.

THE GADGET EDITOR

Mandrel for Threaded Parts

One of the main problems in doing secondary work on internally threaded parts is to hold the work securely and concentric with the threads, while still being able to easily remove it from the holding device. On the part shown, the O.D. was polished and would not allow use of any sort of gripping device to loosen. As there were only a few of the parts, a simple but effective work holder was made as shown.



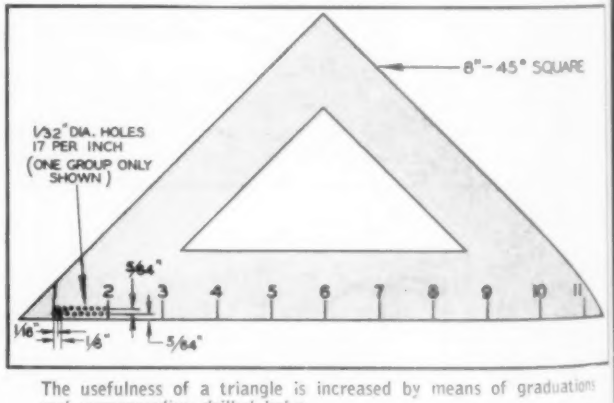
Collapsing mandrel permits easy removal of threaded workpiece.

The mandrel was made of tool steel, left soft, and turned to fit the lathe headstock taper. It was then put into the headstock, finish turned, threads chased a free fit, and a shoulder faced to screw the parts against. The threaded end was then slit, along the center line, and a hole for a set screw drilled and tapped through one side. The opposite end of the screw was "spotted" concave to seat a steel ball.

In use, the work is screwed on by hand, snug against the shoulder, and the set screw tightened to expand the holder. After turning the shoulders and drilling a hole half through the part, the set screw is loosened and the part can be screwed off easily without the aid of a wrench. Even though the cutting pressure of the tool tightened the part hard against the shoulder, when the set screw was loosened the pitch diameter of the thread was reduced enough to allow its easy removal.

Geo. W. Brown
Atlanta Chapter, ASTE

Versatile Drafting Tool



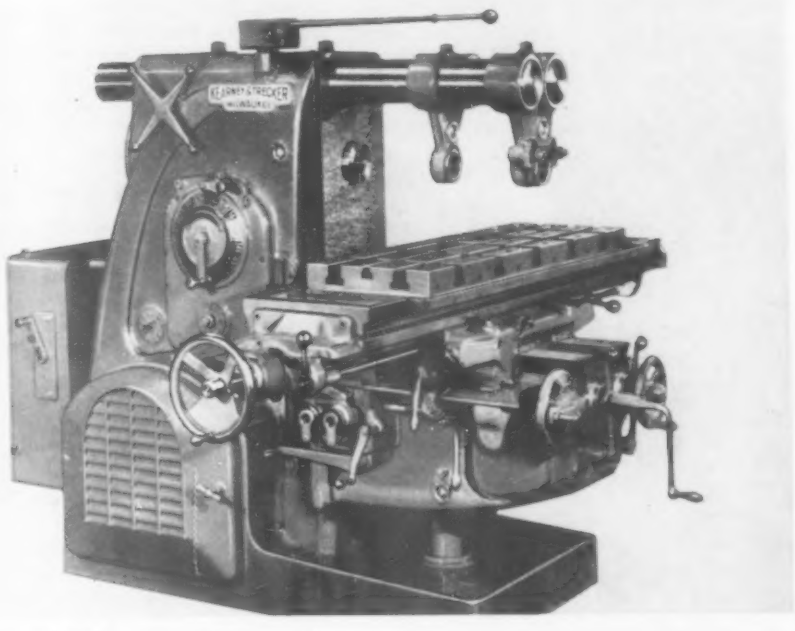
The usefulness of a triangle is increased by means of graduations and corresponding drilled holes.

Compasses tend to become unsteady when drawing large radii, resulting in eccentric circles. By graduating the hypotenuse of a triangle, and drilling small holes to coincide with the graduations, large radii can be drawn without use of a compass. Insert a pin through the end hole, and a pencil point through the proper hole, and draw. By turning the triangle on its side, the holes can be used as lettering guides.

William E. Theriault
Montreal Chapter, ASTE

TOOLS OF TODAY

Chucking Table Milling Machines

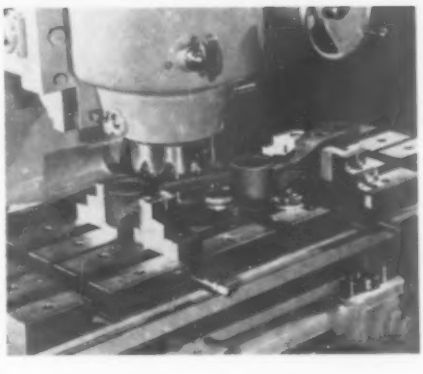


A line of Knee-type Milling Machines, featuring a built-in chucking table to simplify workholding problems, was announced simultaneously with the publishing of a 24-page catalog by Kearney & Trecker Corp., Milwaukee, Wisconsin.

This milling machine is designed to facilitate the handling of irregularly-shaped workpieces without resort to costly special tooling fixtures. The design of the table is such that, with certain simplified vise jaws and standard setup accessories, a chucking mechanism is provided to handle various shaped workpieces with a minimum of time for setup.

The chucking table, cast in one piece, is precision made throughout for accurate positioning of jaw bases and accessories to meet exacting requirements of setup. A typical setup is indicated in the smaller photo, which shows a detail of the No. 5 K & T Vertical Chucking Table Milling Machine. Twenty-four machines of this class are available in plain or vertical styles, with or without automatic cycle mono-lever table control, in two sizes:—No. 4 and No. 5, having 42 in., and 50 in. power table travel, respectively. Power capacities range from 20 to 50 hp. Noteworthy features include:

Deep well coolant drain to provide fast, clean return; self-cleaning stop holes, accurately bored and conveniently located, ready for bumper stops when setup requires them; longitudinal T-slots, precision milled for positive alignment of jaw bases and jacks. Center T-slot is standard to accommodate vises, rotary tables or other accessories.



Transverse T-slots—five in number—spaced for maximum workholding capacity within the range of the table. As a result, large and small workpieces can be set up with equal facility. A mono-lever table control, for feed and rapid traverse, simplifies machine operation and reduces operator fatigue. This is a standard feature on automtic cycle machines.

These are but a few of the many features claimed for this machine; however, full details on job studies and machine specifications may be obtained by writing the manufacturer for Catalog CT-10. **T-9-1**

Second Operation Machine

Hardinge Brothers, Inc., Elmira, N. Y. announce their Model AC 59 High Speed Precision Second Operation Machine which, incorporating all the features of their present line of second operation machines, has the additional feature of an air-operated collet.

The latter feature is designed to meet a need for faster operation, particularly true where machining time is short and chucking must be correspondingly fast. The collet closes and opens by actuating a foot valve, thus leaving both hands of the operator free to load, actuate tool slides, unload and otherwise handle the work.

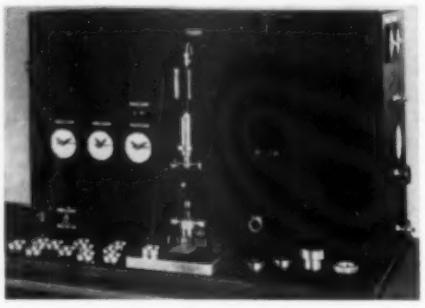
The air-operated collet, which operates on standard airline pressures, is said to accurately hold work without distortion even when there is considerable variation in diameters, piece for piece. The standard 5C Hardinge collet or steep chuck may be instantly closed or opened when the spindle is at rest, or at any speed within the range of the machine.

The preloaded ball bearing center-drive headstock spindle offers 1 in. round, 7/8 in. hexagon, and 3/4 in. square collet capacity; step chuck capacity to 6 in. Eight spindle speeds are available, in either forward or reverse direction, from 250 to 4000 rpm. Three other speed ranges are available for varied production requirements.

Other features include Hardinge precision hardened and ground dovetail bed ways, constant full bearing double tool cross slide, automatic indexing six-position preloaded ball bearing turret, self-draining oil pan with integral sump, and welded steel pedestal base. **T-9-2**

Pneumatic Comparator Gage

Bore, taper, and all finished dimensions on automotive roller bearing races are measured simultaneously by an automatic Pneumatic Comparator Gage, made by Moore Products Co., Philadelphia 24, Pa. As stated by the manufacturer, the instrument furnishes a direct reading of taper variations as small as 0.00005 in., sorts the pieces that are within all tolerances, and has been used at speeds up to 1700 pieces per hour.



Thickness, O.D., large I.D., and small I.D. are measured in one operation by separate air gage components. Positioning of the work is not critical, nor is accuracy affected by the human elementor by progressive wear. The pneumatic gaging elements are interchangeable, so that various sizes of cups can be inspected.

The operator feeds the work on the tungsten carbide platen. A pneumatic-electric system brings the pneumatic plug down to the gaging position, retracts the plug, and ejects the work either into an acceptance chute or into a rejection chute. Indicators for each dimension, and master signal lights indicate the condition of each workpiece.

The taper measurement is achieved by applying the air gaging pressures of both the large I.D. circuit and the small I.D. circuit to a differential-pressure transmitter. As set by the master, desired taper produces zero differential. Deviations from this taper are indicated above or below the center zero of the "taper" indicator. The I.D. indicators can be used to measure diameter or stand-out. T-9-3

Motorized Centers

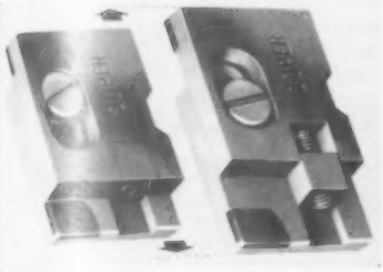
Grinding of flat, curved or circular work; straight, taper and contour outlines, simple or in any combination and all within 0.0005 in., is claimed for the Motorized Centers developed by the Moore Special Tool Co., Bridgeport 7, Conn.

The attachment, which provides for indexing in the same setting, can also be used on jig borers, jig grinders, drill presses, light milling machines and as an inspection tool in addition to its use on surface grinders.

The attachment consists of a rocking bed which will swing 20 deg to either side of horizontal, or 30 deg when used with an angle plate. Upon this bed is

clamped the base plate, dovetailed to permit positioning the head and tailstocks. The head-stock is equipped with a live center and an index plate with 24 holes, jig drilled to a tolerance of ±0.001 in. The head-stock is mounted on pre-loaded precision ball bearings. To a great degree the versatility of this device is a result of the simple tailstock center which readily permits the use of special centers, such as external-internal, and cutaways.

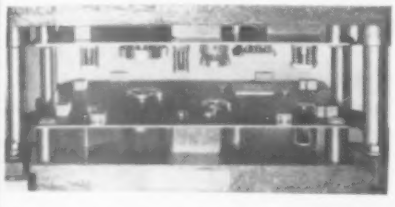
The attachment is said to make possible work which ordinarily requires a large, expensive machine or a variety of special tools and attachments. Since tapers can be reversed or changed by loosening two screws in the rocking bed, and the indexing plate can be engaged by merely pressing a plunger, all steps can be accomplished with the same set-up. T-9-4



Expansion Reamer Blades

Super Tool Company, 21650 Hoover Rd., Detroit 13, announces a line of carbide-tipped adjustable Expanison Blades for use with standard reamers and boring bars. A wide range of standard sizes up to 4 in. are said to be ready for "off-the-shelf" delivery.

Construction of the blades is simple, as suggested by the photo of blades in closed and expanded positions. The two halves are held in parallel alignment by means of a tongue and groove, and are locked securely by a screw in the recessed slot. **T-9-5**



Magnetic Perforating Dies

A faster way of making up die sets for the piercing of holes in materials up to and including $\frac{1}{8}$ in. mild sheet steel is claimed for Whistler Magnetic Perforating Punches and Dies, by S. B. Whistler and Sons, Inc., Buffalo, N. Y. Also claimed is precision perforating with tolerances held to 0.0005 in—or as close as can be jig bored.

The punches and dies are assembled in templet mounting plates. On completion of any job, punches, dies and retainers are quickly removable and ready for use in a new arrangement. Only the two templets—all that are necessary to duplicate the original job at any time—are then stored.

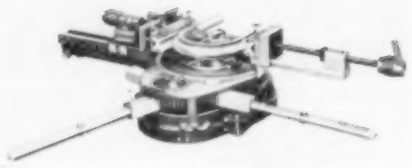
Standard sizes of punches, dies, bushings, and retainers for perforating round, oval, square or rectangular holes from $\frac{1}{32}$ to 3 in. diameters are available from stock, with special shapes or sizes quickly made to order. Catalog M48, which fully describes these punches and dies, and all related parts, is available on request. **T-9-6**

Turn to Page 80
for Handy
Tools of Today
Coupon

10-Inch Lathe by Sheldon

Sheldon Machine Co., Inc., 4258 N. Knox Ave., Chicago 41, announces a moderately-priced Lathe of 10 in. swing and provided with a 1-$\frac{3}{8}$ in. hole through the spindle. Known as the "XL" series, this lathe has been developed especially for factories and school shops having need for large collet capacity while yet restricted in budgets or floor space.

Other features of this lathe are: large precision roller bearings, a 4-speed (8 spindle speeds) V-belt underneath motor drive; full double-walled, worm feed apron; full quick change gears, full enclosed headstock with hinged cast aluminum cover; and standard "big lathe" features. The machine will come with 38 to 44 in. bed length on a 3-drawer steel bench, or with a pedestal base in lengths up to 62 in. **T-9-7**

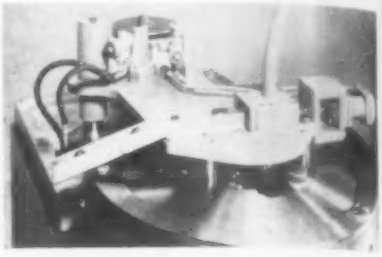


Parker Hand Bender

A manually-operated production Tube Bender—Model 848 by The Parker Appliance Co., 17325 Euclid Ave., Cleveland 12—is designed for the general utility bending of tubing up to 3 in. in diameter. Complementing the Parker G824 bender having a capacity of 1-½ in. OD tube, and using the same accessory equipment, Model 848 accommodates thin or heavy wall copper and aluminum alloy tubing, and light or medium gage annealed steel tube.

The bender, operated by hand levers, actuates a central spindle and the attached radius block through gearing at ratios of 30-1 or 8-1. Bends up to 180 deg may be made, including offset bends and U-bends in the middle of long tubes. The machine is reversible, and tube clamping and radius froming assemblies may be mounted on either side. Successive right-and left-hand bends can be made with bend radii ranging from 1-¼ to 12 in.

Radius blocks, clamp blocks, slide blocks and mandrels are available for all standard sizes of tubing. Accessory equipment includes pneumatic mandrel extractors to speed the extraction of mandrels in smaller radius work; side angle indicators for the gaging of angles in different planes; and special work tables and tool cabinets. T-9-8



Pipe Thread Rolling Machine

A Cylindrical Die-Thread Rolling Machine, by the Reed Rolled Thread Co., Worcester, Mass., incorporates three synchronously cylindrical dies which, acting on the blank simultaneously, hold it rigidly in proper rolling position. Feed is affected by cam actuated toggles to insure definite and controlled rate of penetration, predetermined length of dwell and positive duplication of size.

The Reed Model A22 and A23 machines may be supplied with either manual or semi-automatic feeds suitable for rolling 1/16 in. to 2 in. pipe threads at stated rates of 300 to 1500 per hour. They are suited to thread rolling of pipe plugs and fittings made from brass, bronze, alluminum and steel, stainless included.

The model A22 machine, shown, is arranged with a simple semi-automatic feed for pipe plugs. The operator feeds the blanks into the tube, after which the rest of the cycle—loading the work in the dies, rolling and unloading—is fully automatic. T-9-9

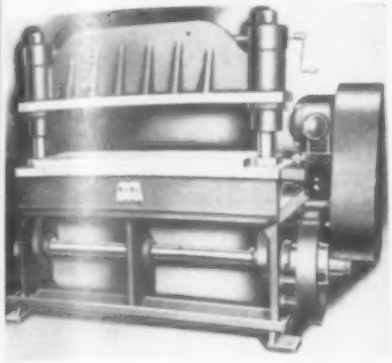
Tension Wrench

An improved tension wrench, announced by the Sunnen Products Company, St. Louis 17, Mo., has a stated high limit of 100 foot-pounds, which can be increased to 150 foot-pounds by using an extension designed for the purpose. A special feature of this wrench is that it is calibrated in both foot-pounds and centimeter-kilograms.

The manufacturer claims an unusual advantage for the wrench, in that there are no dials or pointers to read, or lights to watch. The operator merely sets the adjustment to the tension desired; a toggle action releases the pressure when the desired tension is reached. The setting remains fixed and resets automatically until changed manually.

This tension wrench is recommended by the maker for all industrial applications in which nuts or bolts are tightened to specification or where tension must be controlled. T-9-10

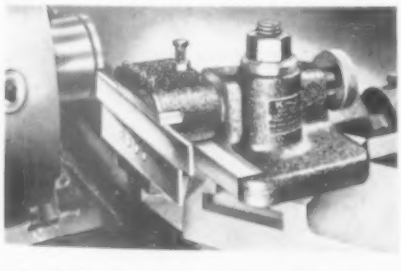
Large Bolster Area Press



Rated at 30 tons capacity and unique in design, the Diamond Model 3048 Multi-Max Punch Press, by the Diamond Machine Tool Company, Los Angeles, Calif., combines a large bolster area of 16 x 48 in. and a ram area of 10 x 48½ in. This combination makes possible a wide variety of metal stamping operations economically, including blanking, piercing, notching, bending, shearing and drawing. It may also be used for many diversified applications such as cutting felt and fiber material with the use of steel rule dies.

The large bolster and ram area is possible because of compact design together with underneath double-crank-drive mechanism. The press is of all steel weld construction with a 4-point engaging clutch. Standard stroke is 2 in. and maximum stroke to order is 4 in. Speed is 80 strokes per minute, standard shut die height is 10 in., with maximum to order practically unlimited. Ram adjustment is 2 in. and crank-shaft is 3 in. in diameter. **T-9-11**

Quick-Change Tool Holders



Typical of a line of quick-change Tool Holders by the Biggstava Company, 3357 Union Pacific Ave., Los Angeles 23, Calif., is the lathe cut-off tool illustrated. As the cut-off tool incorporates a heavy taper shank, drawn solidly into the toolpost mounted holder, it is not only immovably centered but square with the work and with a minimum of overhang.

Interchangeable, in the holder, are an unusual line of lathe tools that includes knurls, threading and boring tools and even a milling fixture. Any tool is quickly removed and another inserted; thus, the entire set provides a setup comparable to that effected with combination toolpost and tailstock turrets. All fully described in a comprehensive bulletin, available on request. **T-9-12**

Insert Grinding Fixture

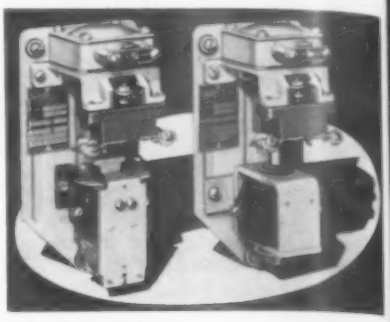
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich., announces a fixture for sharpening and grinding chip breakers on the inserts for their ejector type tools.

Described as the Super Ejector Tool Insert Grinding Fixture, the device is designed to provide ample clearance for grinding any insert with either flat or dished chip breaker, with ready duplication of established grinds.

Two calibrated setting dials provide for accurate adjustment in any position and cam index plates speed up the grinding of rectangular, square and triangular inserts. The stop is lifted out of position for grinding round inserts. Collets are available for all type inserts in standard sizes. **T-9-13**

D-C Pneumatic Timers

A D-C Pneumatic Timer—Class 9050—announced by the Square D Company, is similar in construction to the company's A-C design, and includes the same claimed advantages.

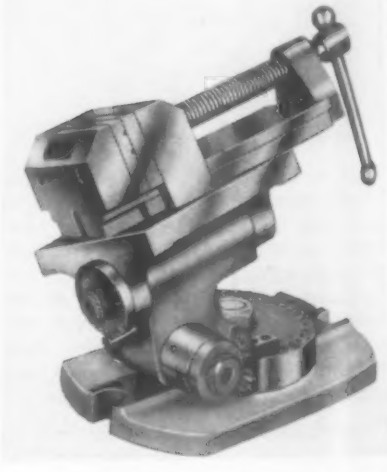


Features claimed for the device are: accurate timing—less than 10 percent variation, plus or minus, from the mean timing period—unaffected by normal changes in voltage and ambient temperature; wide range and easy timing adjustment; and snap action contacts electrical interlocks operated by the magnet which actuates the timing mechanism.

Usual applications are found in timing motor acceleration, machine sequences, process industry operations, resistance welds and similar functions. Further information available in Bulletin 9050, by Square D Co., 4041 N. Richards St., Milwaukee 12, Wis. **T-9-14**

Angle Precision Vise

Natco Tool Company, 2830-36 W. Lake St., Chicago 12, Ill. announces the All-Angle Precision Vise, available in sizes 3½ to 4½ in. width of jaw. The cradle has 90 deg range—45 deg on each side of horizontal—and the base swivels 180 deg vertical setting to 90 deg.



The vise features a screw for fine angle setting and to eliminate falling of the bed when the bolt is loosened. Designed for drilling, counterboring and similar operations, a universal attachment adapts it as a jig or fixture. **T-9-15**

Portable Vertical Sander

A Vertical Sander, weighing less than 9 lb, with an overall height of 7 in., is announced by Buckeye Tools Corp., Dayton 1, Ohio. This addition to the Buckeye line of air and electric powered portable tools is a medium-duty model said to be particularly suited for precision work because of its unusual ease of handling.

The tool is also designed for use as a grinder with cup-type, counter-bored center wheels and cup wire brushes, is available in free speeds of 4500, 5500, 6000, 7200 and 8500 rpm. and is equipped with the stream-power governor to assure constant speed under load.

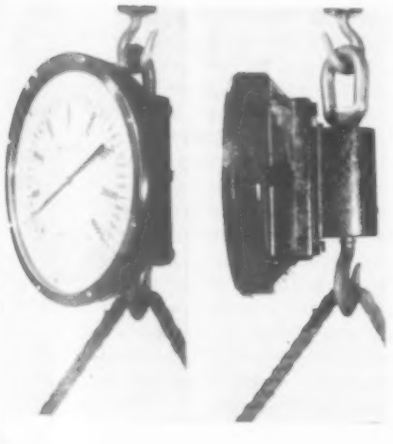
T-9-16

Hydraulic Scale

The Hydroscale, by Hydroway Scales, Inc., Detroit, Mich., is a portable scale designed for heavy-duty weighing, drag, pull, torque and safety-factor determination. A hydraulic unit, it functions on the static pressure principle and may be adapted to special, direct or indirect remote in any of the applications stated.

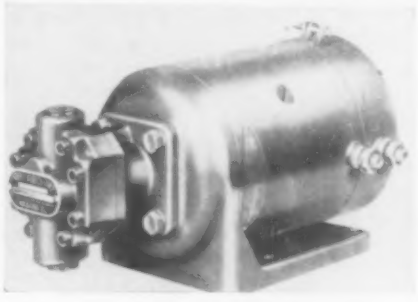
Having a 4 to 1 ratio of stated capacity and designed to withstand shock loads up to 20 percent of maximum capacity, it is said to have a minimum of non-wearing working parts and is permanently sealed against weather and corrosive elements.

It is made in four basic sizes ranging from 500 to 40,000 lb., dial sizes from 7 to 30 in. in diameter. Distributed by Portable Hydraulic Scales, Inc., 3020 E. Grand Blvd., Detroit 2, Mich. **T-9-17**



Rotary Gear Pumps

The John S. Barnes Corporation, 177 Walnut St., Rockford, Ill., announces an added unit to its line of Barnes Constant-Flo Rotary Gear Pumps. This addition to the Barnes family consists of a pump and motor unit, exactly mated to each other to assure maximum efficiency of both pump and motor.

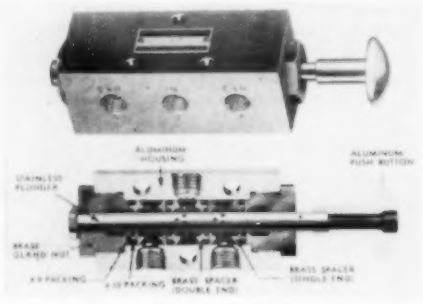


Intended for use with automotive and battery powered equipment, this unit combines the specific model of the Barnes Constant-Flo Rotary Gear Pump best suited to a customer's requirements with a special 12-volt series-wound motor of an exceptionally sturdy design. Delivery rate is 2.5 gal. per minute at 650 psi; 2 g.p.m. at 1000 psi. Maximum pressure is 1500 psi.

Catalog sheets giving complete engineering data will be supplied upon request. **T-9-18**

Single-Plunger Control Valve

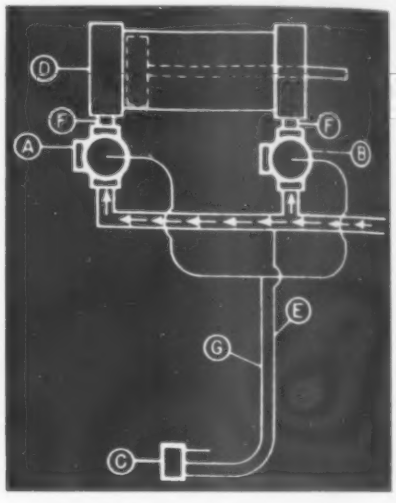
C. B. Hunt & Son, Inc., Salem, Ohio, has introduced an entire line of small single-plunger valves known as Series "O" and "OE". As claimed by the manufacturer, these valves feature design, sturdy construction and extreme ease of operation, resulting in a minimum of operator fatigue. Consequently, they are well suited for use with manually controlled presses, pilot circuits, and in other processing cycles when frequent manual operation is required. Construction is clearly illustrated in the sectional view.



The valves are balanced and will remain in position until changed. A spring can be mounted between the push button and gland nut when spring return action is desired. The flow is through the plunger and around—not through—the seals, to prolong the life of packing and valve parts. The valves can be completely disassembled for repacking, and are readily reassembled without disturbing the piping.

The valves are furnished tapped for either ⅛ in. or ¼ in. pipe and are available in 2-way, 4-way, and 5-way designs; and with either push-pull or push-and-spring return actions. They are suited for use with air, oil or water at pressures up to 125 psi maximum—also vacuum—at normal temperatures not exceeding 150 deg F. Class "O" valves have piped exhaust. The "OE" valves have an open exhaust, and should be used with air only. Data sheets giving complete specifications are available on request. T-9-19

In-Line Master Valve



Marked production increases, combined with lower costs, are claimed for a type of valve installation centered around a Full-Flo Master Valve recently announced by Ross Operating Valve Company, 120 E. Golden Gate, Detroit 3, Mich.

Instead of the conventional mounting of a 4-way valve at some distance from the cylinder, the Ross method places 3-way valves A and B—one normally open and one normally closed—at each end of the cylinder, D. Operation is effected by a small pilot valve, C, which can be manually, mechanically or electrically actuated.

By this arrangement, lengths of large-diameter pipe between valve and cylinder—ordinarily filled and exhausted with non-productive air—are replaced by short nipples, F. Air supply is received by the pilot valve and dispatched to the master by means of tubing—E & G—with resultant saving in air with every movement of the piston.

The close coupling of the valve to the cylinder increases production because of quicker exhaust-dumping and consequent faster movement of the cylinder piston. In addition to easier operation of the smaller pilot controlling valve and a more pleasing appearance of the installation as a whole, the mounting method is especially advantageous where increased operating speed is required. T-9-20

Automatic Wheel Dresser

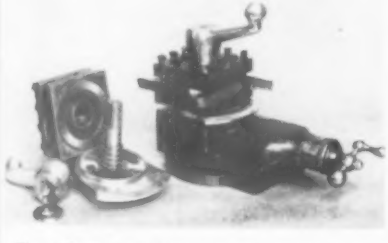
An automatic diamond wheel dresser—the "DressOmeter", by J. K. Smit & Sons, 157 Chambers St., New York 7, N. Y.—incorporates a novel arrangement whereby the compression of a plunger against the end guard of the grinding machine rotates the diamond 22½ deg on each pass across the wheel face.

Obviating the need of unclamping the tool holder and turning the diamond by hand, this arrangement automatically insures the most effective cutting surfaces on 16 facets—said to provide the most economical diamond contact area. Of rigid construction, the DressOmeter is further enclosed in a dustproof housing to exclude grits and grinds, thus prolonging life of both the diamond tool and the actuator. The tool is readily installed and, as claimed, no special operator training is required for its use.

The tool is fully described in an illustrated catalog, available on request by mentioning THE TOOL ENGINEER.

T-9-21

Close-Indexing Turret



The "French" Turret Tool Post, by O. K. Rubber Welding Mfg. Co., Littleton, Colo., is unique in that it can be indexed to 120 positions or 3 deg apart. Thus, in addition to straight-in or straight-on cuts, turning tools may be side or in-fed at practically any angle within the range of index.

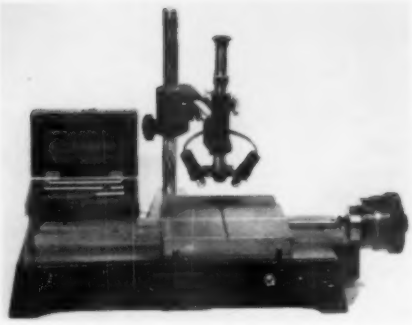
The turrets are available in sizes 2-¾ to 7 in. square for lathes 9 to 30 in. swing and taking tool sizes ¼ to 1-½ in. square. Fitted to the lathe cross slide or compound rest, they can be mounted or removed as desired, or, may be left on to replace the regular tool post. Full particulars in a bulletin, available from the manufacturers.

T-9-22

Toolmaker's Microscope

Designed for use in tool rooms and mold and die shops, a Toolmakers' Microscope, by Boeckeler Instrument Co., Tucson, Arizona, is said to combine the features of outstanding capacity and high accuracy with low cost.

Range of stage travel is 10¼ in., said to be the maximum extent for point-to-point measurement. Die blanks and molds, weighing up to 100 lbs., can be placed in the stage and may even overhang a considerable distance. As a feature, the stage is easily moved by hand, without resort to finding a long lead screw. Precision end measuring



rods are used to set the stage, which may then be adjusted by the micrometer dial shown at extreme right. The micrometer head is graduated to 0.0001 in., and is certified accurate at any setting to 0.000025 in.

The instrument is said to be quickly and accurately set for any object under inspection, with simple determination being made in a minute or less. Fully described in a comprehensive bulletin, available on request. T-9-22

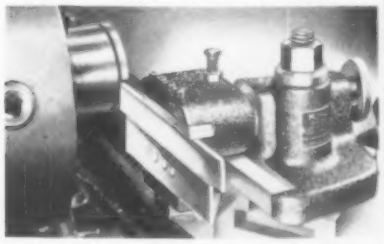
Clip for Thread Chasers

Supermetric thread chasers, by the Geometric Tool Co., Blake & Valley Sts., New Haven 15, Conn., are now held in a spring steel clip instead of being wired as heretofore.

The clip, designed to prevent loss of individual chasers or mixing with other sets, simplifies handling. It also saves the time ordinarily consumed in removing the conventional wire tie and in rewiring after use. T-9-24

Engine Lathe Cutoff Tool

A novel type of Cutoff Tool Holder announced by the Bigg-Stava Co. of Los Angeles, Calif., rests on a supporting blade which is slightly concave along the top edge while the lower edge of the cutoff blade is convexed to fit. This solid support is said to eliminate the chatter, tool breakage and slow operation that frequently occurs in cutoff operation on engine lathes and to permit feeding into the work under power with no chatter or vibration.



The holder acommodates any standard ground or unground cutoff blade, and an adjusting screw enables the operator to adjust the blade to the correct height without disturbing the adjustment of other tools he may be using in the quick change tool holder base. The screw rests on a hardened button to assure accurate repeating. The tool is one of a line of 13 standard quick-change tool-bit holders made in 5 sizes for lathes with swings from 9 to 72 in. T-9-25

TURN TO PAGE 80
FOR HANDY
"TOOLS OF TODAY"
COUPON

Spider-Type Precisionaire

A spider-type Gaging Spindle said to completely eliminate the cocking and sticking often encountered in checking shallow, large diameter holes which offer a minimum of bearing when the spindle is presented, has been developed by the Sheffield Corporation, Dayton 1, Ohio. Shown here checking a ring gear, it is used with the Precisionaire, a flow-type air gage for checking internal diameters, bell mouth, out-of-round and the average diameters. The inset shows reverse side.

The spindle is designed to easily enter shallow holes regardless of the manner in which it is presented to the part. It is made considerably lighter in weight than the conventional spindle, for continuous handling without undue fatigue. A flexible hose connection to the instrument facilitates handling and use.

The spindle is said to make possible a reading with accuracy entirely unaffected by relatively rough surface finish, and is balanced for complete rotational accuracy. Diameter locating surfaces are faced with tungsten carbide for long wear life. **T-9-26**

Colmonoy Center Tips

Lathe or grinder centers, worn too far back for further grinding, may be restored to full usefulness and indefinitely extended life by retipping with Colmonoy wear resistant tips. The tips may be silver soldered to the worn centers at a cost said to be far less than the purchase price of high-speed steel centers.

The Colmonoy tips, in cast form or already applied to standard size centers, are available from Diamonds and Tools, Inc., Division of Wall Colmonoy Co., 19345 John R St., Detroit 3. **T-9-27**

3-Way Solenoid Valves

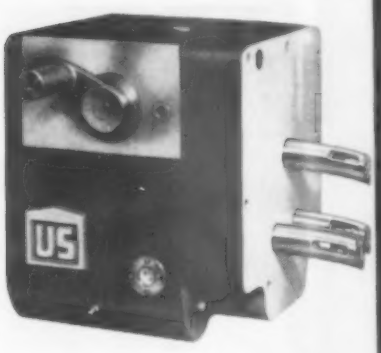
Skinner Electric Valve Division of The Skinner Chuck Co., Norwalk, Conn., announces a line of 3-way bronze body Solenoid Valves, designated Series M-3. These valves are designed for continuous or intermittent duty with petroleum oils, water, air and inert gases with operating pressures from 20 to 150 psi. Normally open, normally closed, and directional flow control types are available with full $\frac{3}{8}$ in. orifice and $\frac{3}{8}$ or $\frac{1}{2}$ in. N.P.T. ports.

All internal metal parts are brass or stainless steel. Soft synthetic inserts prevent leakage, and a spring loaded pilot insures positive closing with the valve mounted in any position. The diaphram is made of tough coated nylon fabric for long life.

The valves are fully described in Bulletin No. 493, which is replete with line drawings, specifications, types, sizes, capacities and operations.

T-9-28

Fixed-Center Drill Head



A multiple-spindle Drill Head, by U. S. Drill Head Co., Cincinnati 4, Ohio, is designed to provide the correct peripheral speed of drills, taps, and reamers, from a single-speed drive unit, when machining different materials. This head can be built with any number of spindles to cover any area, and can be used on any kind of mounting.

The head is oil-lubricated for operation at high speeds— maximum recommended 12,000 rpm. The gears, of heat-treated high carbon alloy steel, are of helical type for noiseless operation. A small helix angle keeps end thrust at a minimum, and all shafts are mounted on ball bearings. Spindle speeds are changed by means of specially designed sliding type gears. This is done by rotating the head lever 180 degrees, when the gears are locked in place by a spring-operated plunger.

Speed of all spindles need not be changed when only some spindles, performing such multiple operations as tapping or facing large diameters, are needed. For instance, if a multiple operation includes tapping, facing and drilling, then only the tapping and facing spindles require a change in speed.

T-9-29

Automatic Cycle Spark-Timing and Sizing Arrangement

Two Automatic Cycle Arrangements —Spark Timing and Sizing—by the Brown & Sharpe Mfg. Co., Providence 1, R. I., have been designed to complement the usual required accuracy of Brown & Sharpe Nos. 5, 10, 12, 20, 22 and 23, Plain Grinding Machines. In addition, they give the following production boosting features: Reduced idle time of the machine, with less of the operator's attention, and aid in reducing spoiled work to a minimum, all contributing factors to definite lower grinding costs.

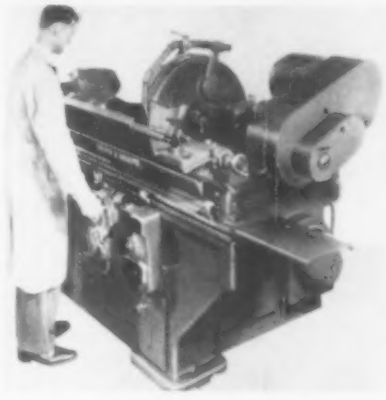
An outstanding feature claimed is the method of bringing the grinding wheel into direct contact with the work while the arrangement is in operation. This permits greater tolerances in previous turning operations and gives practically full-time grinding. There is no need to set the arrangement to favor the high limit of turning tolerances. Furthermore, the conversion of a machine fitted with either of the automatic arrangements to a standard machine for short run lots is said to be accomplished instantly.

The automatic cycle and spark-timing arrangement assures rapid uniformity of sizing and finish because the spark time is set at a predetermined figure. Spark time is adjustable 2 to 180 seconds. When grinding is completed, the wheel slide withdraws automatically, the headstock stops and the coolant is shut off. The work is sized from the machine's accurate crossfeed mechanism.

After loading, the operator makes a single oscillatory movement of the crossfield handwheel, bringing the wheel into direct contact with the work, and engages the pawl. After that, the cycle is completed automatically.

The automatic cycle and sizing arrangement further reduces the operating skill and effort required for accurate production grinding. Sizing directly from the work, it eliminates compensating for wheel wear and the effects of wheel truing.

Before reaching the finished size the cycle switches from coarse to fine feed by means of a predetermined setting of the work-sizing gage. Reduction in work diameter, per revolution of headstock, may be readily selected by knobs on the front of the control cabinet. Indicating lights on the front of the panel are a decided aid when setting up, thus simplifying the gage setting in conjunction with a master. **T-9-30**



At left, a No. 22 B & S Plain Grinding Machine fitted with Automatic Cycle and Spark-Timing Arrangement. At right, a No. 10 Plain Grinding Machine equipped with Automatic Cycle and Sizing Arangement.

CORRECTION: In the item "Carbide-Tipped Saw Blades", July, THE TOOL ENGINEER, key No. T-7-13, the address of the manufacturer was incorrectly stated. Inquiries should be addressed to Motch & Merryweather Machinery Co., 715 Penton Bldg., Cleveland 13, Ohio.

Indicating Snap Gage

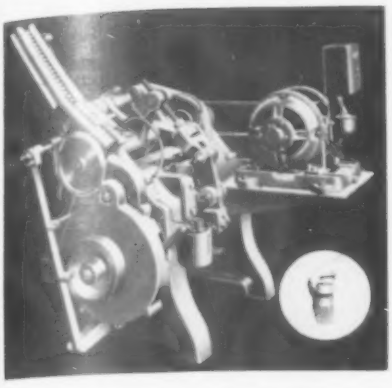
A simple, rugged, and direct reading all-purpose Indicating Snap Gage,—model 1000, by Federal Products Corp., 1144 Eddy St., Providence 1, R. I.—incorporates a dial indicator which, enabling the machine tool operator to constantly check his work, further warns of impending off-size in time to reset the machine.

An important feature of the Model 1000 is that workmen accustomed to conventional "Go-NoGo" gages can handle it in the same manner. The dial indicator, which has cushioned movement, is at top facing the operator; it can, however, be faced in any position for bench or machine use. The contact point is spring-mounted and guarded from sideways blows, and a guard further protects the dial indicator from abusive treatment. Upper and lower contacts are tungsten carbide tipped.

Five sizes cover all dimensions from 0 to 6 in. Two small sizes have cast iron frames, and the three large sizes have aluminum frames with insulated grips. A bench stand is also available. Size capacities are as follows: 0 to 1 in., ¾ to 2 in., 1-¾ to 3-¼ in., 3 to 4½ in., and 4 to 6 in. Can be had with either B5M-C (0.0005 in.) or B2I-C (0.0001 in.) Federal Indicator. T-9-31

Speed Counter

Rotation of shafting, motors, machine spindles and similar equipment may be readily checked with the Clutch Speed Counter, by Veeder—Root, Inc., Hartford 2, Conn. Rpm is quickly and accurately timed by using any watch having a second hand. Counts to 10,000 and repeats. Maximum recommended speed 2500 rpm. T-9-32

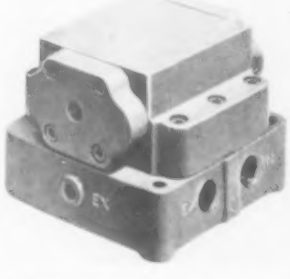


Thread and Trim Machine

The V & O Press Company, Division of Rockwell Manufacturing Co., Hudson, N. Y., announces No. 302 Threading and Trimming Machine which, in addition to threading and trimming, can also be utilized for beading, knurling and curling, either as separate operations or in combination.

In producing the can shown in the inset, for example, parts are placed in a chute by the operator and are then fed automatically to the chuck, threaded, and automatically ejected at a stated rate of 35 cans per minute. By interchanging chucks, the cover of the can is handled with the same sequence of operations. Other items, such as flashlights, film cans, bottle caps, lipstick holders and so on, are similiarly being produced on the machine, which is designed to handle products made of material up to 3/32 in. thick. **T-9-33**

Four-Way Mastair Valve



A 4-way "Mastair" Valve of the balanced spool type, controlled by one 4-way or two 3-way pilot valves and including features said to offer high standards of efficient control, is announced by Hanna Engineering Works, 1765 Elston Ave., Chicago 22.

Because of straight-line piping, few fittings are needed. Pipe may be connected to bottom or sides, as desired, and parts may be removed without disconnecting pipe. Spool and sleeve assembly is readily taken out by removing the end caps, and parts are interchangeable in any size. Capacities of $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 in. are of fully rated pipe size. Control pilot valves are available in cam, lever, push-button and foot operated types.

Design, construction and operation information, specifications and circuit diagrams are included in Hanna Valve Catalog 251. **T-9-34**

Resin Bonded Wheel Grinding

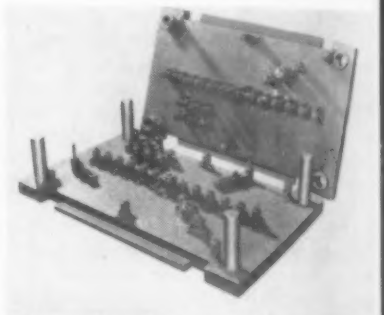
Simonds Abrasive Co., Tacony and Fraley Sts., Philadelphia 37, Pa., announces Fibrex Red Wheels, a synthetic resin bonded grinding wheel said to have extra strength and durability. Manufactured from laminated sheets of cotton fibre filled with abrasive grain, their field of application is between that of heavy grinding and light sanding as well as for certain types of abrasive cutting-off, deburring and finishing operations.

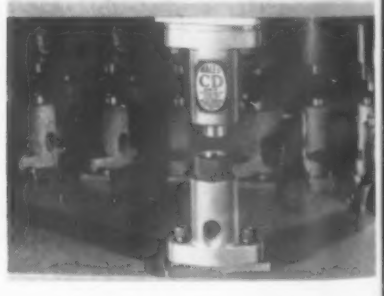
They are offered in 7 and 9 in. depressed center type for use on portable disc sanders and right angle type portable grinders, and in straight wheels 8, 10 and 12 in. by ⅛ in. thickness for cutting-off and general purpose use. Slightly flexible, the Fibrex Red Wheel allows a certain amount of side pressure without risk of wheel breakage and cuts fast and clean without fraying or tearing out at the edge. These wheels are said to have numerous advantages for weld grinding, particularly on stainless steel. Bulletin ESA-186 gives complete details.

T-9-32

Adapter Hole Punching Units

Wales-Strippit Corp., North Tonawanda, N. Y., announces an Adapter Setup, for use with Wales Type "CD" Hole Punching Units, designed to eliminate the necessity of large ground steel plates and accurate hole drilling equipment. It assures extreme accuracy of hole locations by mounting and permanently doweling Type "CD" Hole Punching Units to die set; permits the use of these units in combination with blanking and forming dies; and further provides easier mounting for permanent dies. Each punch and die assembly is independent and self-contained.



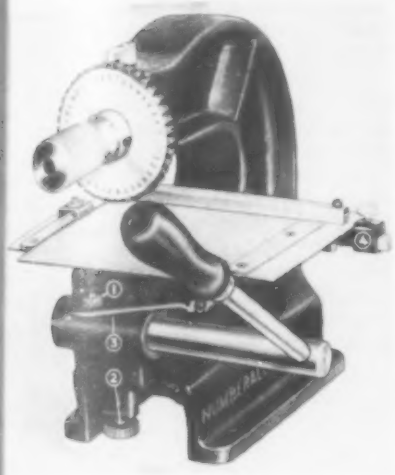


Only four quick, easy steps are said to be required to mount the Hole Punching Units in a die set with Adapters; 1, drill and tap mounting screw holes in die set; 2, mount punch assemblies in position and dowel; 3, align die assemblies with punch assemblies in position and dowel; and 4, locate gages when the setup is ready to operate.

Because they are standardized, the Type "CD" hole punching units eliminate special stripper plates, punches and dies; simplify die, die making and design; reduce setup time and investment in tooling inventory, and reduce die maintenance costs by providing interchangeable parts for all standard units; all at low initial costs. They punch round or shaped holes up to 1½ in. in diameter in ⅛ in. mild steel.

T-9-36

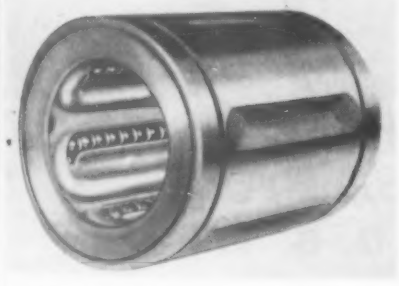
Numbering Press



A Numbering and Lettering Press—Model No. 40A, by Numberall Stamp and Tool Company, 379 Huguenot Ave., Staten Island 12, N. Y.—is designed to impress letters and numbers in all kinds of name plates, tap, keys and similar flat parts.

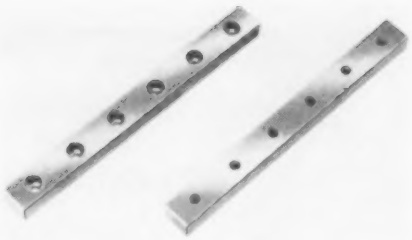
Incorporating a mono-wheel and automatic spacer, the tool has adjusting screw for thickness of workpiece and depth of impression, lever for return of table and adjustable table stop. The dials, 3-¾ in. in diameter, are carefully engraved for clear-cut impressions. Standard dials are furnished with 40 characters, including all the letters of the alphabet A to Z and numbers 1 to 0. Characters may be had in sizes 1/16 to 3/16 in. in increments of 1/32 in. **T-9-37**

Linear Ball Bearing



Thomson Industries, Inc., Manhasset, N. Y., announces a Ball Bushing having a substantially high load rating and suitable for use where shaft rigidity and load capacity are important. This bearing is designed primarily to give anti-friction support to linear motions along 1½ in. diameter guide rods or reciprocating shafts.

The bushing is said to afford extremely low friction and a close fit to the guide rod without the binding and chatter which accompanies close fit plain sliding bushings. The length of stroke is unlimited due to the principle of ball recirculation employed. The outside diameter of the bearing is 2.375 in. and the over-all length is 3.00 in. Complete engineering literature will be sent upon request. **T-9-38**



Wear Strips for Piloted Tools

Aluminum-Bronze Wear Strips, for use on boring bars and driving tools piloted in bushings, are offered by Scully-Jones and Co., 1915 S. Rockwell St., Chicago 8, Ill. These wear strips are designed to practically eliminate seizing and galling caused by high speeds, heavy loads and adverse operating conditions. Cast from Ampco Metal Grade 21, they have a low coefficient of friction and good heat conductivity.

Dissimilarity of material permits smaller clearances between steel bushing and the strips, offering more rigidity to assure accurate cutting operations and confining major wear to the strips. Wiping action of strips keeps chips and dust particles away from mating surfaces of bushing and bar, aiding continuous production at low cost. The strips are available in 6 inch lengths and 5 standard widths. All are 6-hole type, cap screws furnished.

T-9-39

Welder Gun Balancer

A portable Welder Gun Balancer and Hanger, by the Blatz Company, 2043 Sherwood Ave., Detroit 23, Mich., is designed to balance a welding gun in any position in the balancing range without up and down sweep. As it can be moved up and down with only slight pressure, the operator can advantageously spot weld in any desired position.

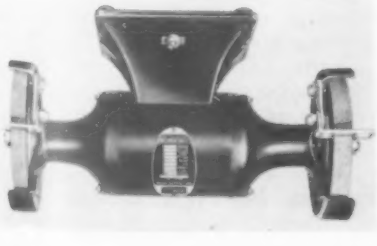
As furnished, the balancer is a complete unit, with trolley, and operates on a standard 4 in. I-beam; however, it can be furnished to operate on Cleveland Tramrail or American Mono-rail as extra equipment. The hanger has a transformer mounting bracket adjustable from 1-½ to 9 in. off center. A swivel conduit tube holds the input and exhaust water hose, control and power wires and air or hydraulic hose to the welding gun. Fully described in a bulletin available on request.

T-9-40

Accessible Bench Grinder

Electro Machines, Inc., Cedarburg, Wis., announces a Bench Grinder for which the manufacturer claims features not usually found in a low-priced grinder. Manufactured under the Doerr trademark and equipped with lifetime lubricated ball bearings, this grinder is designed to provide ample working area for grinding wheels.

Wheel guards are removable for easy attachment of buffing wheels and other grinder accessories. All hardware is cadmium plated, and standard equipment includes heavy-duty 8 ft. cord and plug and two 6 x ¾ in. grinding wheels. Available in ratings of ¼ and ⅓ horsepower at 3450 rpm. T-9-41



THE TOOL ENGINEER'S Service Bureau

Arc Welders

Specifications catalog gives illustrations, descriptions, dimensions of line of "simplified" arc welders including electric motor driven d-c, gasoline engine driven, a-c transformer type and others; features comprising machines individually illustrated and described. Also lists high frequency stabilizer attachment for use with a-c transformer type welder. *Hobart Brothers Co.*, Hobart Square, Troy, Ohio.

Burners

Color folder, SC-142, pictures applications of both suction and atmospheric type burners to typical immersion heating installations; also data tables of heat requirements for water in dip and spray type open tanks. *Surface Combustion Corp.*, Toledo 1, Ohio.

Chuck Jaw Lock and Adjuster

Brochure details operation and adjustment of air chucks with "Accralock" individual precision jaw adjustment feature, providing accurate positioning of jaws and locking when exact setting has been made. *Cushman Chuck Co.*, Hartford 2, Conn.

Cutting Tools

Recently published supplement to Catalog 16 by *National Twist Drill & Tool Co.*, Rochester, Mich., shows line of metal cutting tools for aircraft and light metal industries. Description and price and specification lists follow each illustration.

Electronic Control

Bulletin K-2025 describes VSC electronic excitation control system especially in connection with flexibility of control with regard to economics of rotating motor generating sets as a-c to d-c power converter in the larger horsepowers. *Reliance Electric & Engineering Co.*, 1111 Ivanhoe Rd., Cleveland 10.

Face Mill

Illustrated 8-page catalog on "E-Con-O-Mill" face mill with replaceable carbide tipped blades gives information on bodies, blades, locks and assembled cutters for both cone-type and heavy duty models. *Gairing Tool Co.*, 21223 Hoover Rd., Detroit 32, Mich.

Hole Punching Units

Catalog "CJ" describes and illustrates, in color, hole punching units, giving information on set-up on mounting templates; added details on notching units to be used in combination or independently. *Wales-Strippit Corp.*, 345 Payne Ave., North Tonawanda, N. Y.

Photo Reproduction

Handbook, "How to Use Kodagraph Reproduction Materials" diagrams methods of copying types of drawings and restoring old drawings; includes special sections on copy problems, materials, and instructions for exposing and processing. *Fifty cents. Industrial Photographic Div., Eastman Kodak Co.*, 343 State St., Rochester 4, N. Y.

Plug Gages

Illustrated circular presents advantages of DuBo plug gages; in addition has tables of gage makers' tolerances for DuBo and cylindrical plug gages and tolerances for master discs. *Standard Gage Co., Inc.*, Poughkeepsie, N. Y.

Presses, Hydraulic

Bulletin No. 285 describes and pictures line of presses for forming and drawing, forging, extrusion, plate working, bending and other special work. Capacities range from 5-ton bushing press to 5500-ton rubber pad press. *The Baldwin Locomotive Works*, Philadelphia 42.

Rings

Booklet EDR 1001 by *Waldes Kohinoor, Inc.*, Truarc Sales Div., 47-16 Austel Place, Long Island City 1, N. Y. deals with beveled retaining rings as means of stopping end-play resulting from accumulated tolerances occurring in machine assemblies.

Saws, Radial

Folder No. 1009 presents pictorially advantages of "900" series radial saw for wood and plastic; features model listing, accessories and prices plus standard components. *Walker-Turner Div., Kearney & Trecker Corp.*, Plainfield, N. J.

Taps

Eight-page folder describes, with drawings, exact flute spacing, uniform contours of flutes, precision chip driver contours and concentric chamfers of "balanced action" taps by *Winter Bros. Co., Div. of National Twist Drill & Tool Co.*, Rochester, Mich.

Tester, Micro Hardness

"Kentron" micro hardness tester de-

scribed in Bulletin K-49; includes list of special features and elaboration on action and use. *Kent Cliff Laboratories*, Peekskill, N. Y.

Valves, Hydraulic

Hydraulic valve catalog, Section 201, devoted to description and illustration of 90-model line by *Gerotor May Corp.*, Baltimore 3; including hand, foot, cam, solenoid, oil and air pressure operated valves in standard, spring return, spring centered and ball detent action. Covers working drawings, size specifications, cut-away views and operational diagrams.

Valves, Control

Series DG solenoid controlled 2, 3, and 4-way directional control valves are described in bulletin 4827. Features include compactness, low inrush and holding current, and adaptability resulting from a number of valving modifications. *Vickers Incorporated*, 1416 Oakman Blvd., Detroit.

Valve, Electric Air Control

Electric air control valves are described in recently-released four page bulletin. For control of single or double acting air cylinders, air operated presses and similar equipment, the valve is solenoid controlled and is of the pilot-operated reciprocating disc type. *Hannifin Corp.*, 1101 S. Kilbourn Ave., Chicago 24.

Vise, Hydraulic

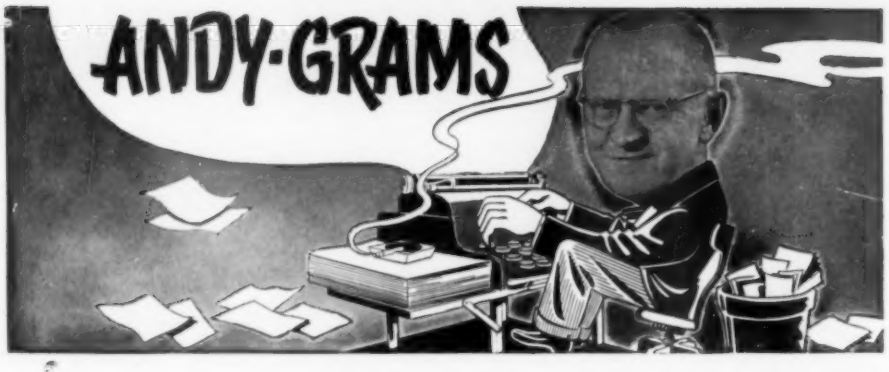
Four page bulletin announces an oil-hydraulic vise featuring foot operation. The vise, which has a 3½ in. jaw width and 6 in. jaw opening, incorporates two foot control pedals, one for power and the other a release. *The Columbian Vise & Mfg. Co.*, 9017 Bessemer Ave., Cleveland 4.

Welding Electrodes

Bulletin 463, the Lincoln Weldirectory for stainless steel, has been released. The bulletin covers electrodes for welding various analyses of stainless, with recommendations for procedure. *The Lincoln Electric Co.*, Cleveland 1.

Welding Electrodes

The tentative specifications booklet for copper and copper-alloy arc welding electrodes issued jointly by AWS and ASTM is now available. The booklet covers ASTM designation B 225-48T and AWS designation A 5.6-48T in ten pages. *Ampco Metal, Inc., Dept. WS*, 1745 South 38 St., Milwaukee 4.



Ordinarily, reviews of new literature are allocated to our Good Reading pages; however, a recent book by Sidney Reibel —Trolley Conveyors, McGraw-Hill Book Company—so intrigued my interest that I'd like to give it personal if somewhat informal mention. Reibel, who is a materials handling consultant, knows his stuff and writes with the authority of personal know-how. His book should help to solve about every materials handling problem in which trolley conveyors play a role.

The book, which is so profusely illustrated that one can get installation and application ideas from the pictures alone, covers plant and conveyor path layouts, operational and maintenance techniques, all slanted toward improved efficiency with reduced operating costs. Not are the illustrations altogether confined to materials handling alone; the author even shows workmen "strap hanging" to a conveyor as a lift up a long, tortuous incline after the day's work is done. In all, a really fine work that should be an inspiration to everyone having to do with materials handling.

Having occasion to have some repairs done to my car, I drove into a local service station where the job was assigned to a personable young mechanic who a/c short-handerness, had to double in brass. As a result, he was kept hopping between my job and recurrent diversions as they rolled in, yet taking it all—my friendly kibitzing included — with commendable good nature. A really swell youngster who, as I found out, had an older brother working along with him, both a credit to the father who happens to be a Floyd Harper of Detroit Chapter. I'll be coming back to see those boys.

Got around to Detroit Chapter's Annual Stag Party during the summer, the day coinciding with the first day of my vacation which, incidentally, was about evenly divided between personal repairs and such diversions as a down-river excursion and botanizing in the back yard. Got intimately acquainted with the birds and bees, so now I know all the facts of life.

Also, as a result of the article "Toolmaking via Lost-Wax Casting," July issue, was picked up by Lee Cuson—local representative for Precision Metalsmiths of Cleveland—who took me out to the National Twist Drill & Tool Company plant out Rochester (Mich.) way, where Carl Oxford showed us around. That's really some plant, one of the finest I've ever visited, and admirably tooled for the ultimate in low-cost production. Carl and his co-workers can be right proud of a job well done.

Also, got around to an ASTE wedding, the bride being Maxine (nee) Erikson, whom the most of you know having seen her glamorizing our conventions besides being a very efficient worker. On hand to help launch the matrimonial ship were ASTE News Editor Doris Pratt, Bob Douglas, Slim McClellan, Halsey Owen and George Goodwin and, of course, the gang from H.Q. If any more of the Society brass were present I missed 'em a/c having to leave early. Now, may the ship have smooth sailing.

Anent my comments about foreign publications in the July Andygrams, I had a letter from ASTEer P. Grodzinski, over in Merrie England, saying that he gets the Russian "Starki i Instrument"—meaning Machines and Instruments—which he implies makes good reading. And all the while I thought that Russian was complicated! Anyway, there are tool engineers in Russia, so now we have at least one common bond with the Reds —that is, outside of such diversions as eating, sleeping, working and building school houses.

In this connection, it may be of interest that literacy in Russia is now 95% as against over 70% illiteracy some 25 years ago. At that, no country on earth has accelerated in education as rapidly as Turkey, which bridged a thousand years after Kemal Ataturk shaved the beard from the Prophet. Maybe we ought to learn more of what's going on around us.

Apropos nothing in particular, the cost of World War II in money alone would have netted the economic independence of every man, woman and child of the earth's 2 billion or more inhabitants for their lifetime and for generations to come. More, it would have provided free education, free libraries, free medicine and happiness instead of more or less universal misery and debt that can never be liquidated. Having made two colossal mistakes on top of a lot of comparatively minor ones, it's about time we learned.

Having received my copy of the Handbook, gratis and all autographed by Editor-in-Chief Frank Wilson a/c having been one of the minor contributors, I took time for a general review. Quite a tome and a credit to all who have worked so hard to put it across. One thing, though—and this is purely my own opinion—I'm wondering if we should include the mathematical tables in later editions.

Personally, I'm averse to thumbing through a thick book for these tables which are to be found in nearly all of the handbooks and which—again in my opinion—are best contained in a separate book confined only to mathematical tables. Am I all alone in this view or do I have company? I'd like to know.

Paid a visit to Andy Anholtt who, with ASTEer Jimmy Giern, runs the Gatco Rotary Bushing Company, formerly the Giern & Anholtt Tool Company. Jimmy, it seems, is enjoying the rural life out Romeo way, making a cool-drawing smoking pipe and other gadgets. In the course of the visit ran across a kidding letter from Tom Barber, of Chicago, whose Tool Service for Industry is handling the Gatco bushings in the Windy City. Well, Tom is handling a popular line and ought to do right well.

From one thing to another, I see where former Prex Herbert Hoover has come in for a lot of belated recognition of late, and what I get a bang out of is the way the newspapers who formerly traduced him are now vieing to pay him honor as the outstanding American. Personally, I'm glad that I was never one of the anvil chorus that clanged away at him during the dark days of he depression when he was literally moving mountains with which to stem the tide. On the contrary, I have held him in high esteem both for his moral integrity and innate honesty as well as for his refusal to be swayed by petty politicians.

Seems that, given time enough, truth will out in spite of smearing by pettifoggers. Inversely, an individual whose thinly coated veneer is but a microinch-thick covering for baser metal may be lauded to the skies, only to have the dross exposed at the first blast of adverse publicity. Time levels all things and reduces it to its basic worth.

Speaking for myself, I like people and prefer to see the good in them. For that matter, I do see good in the most of 'em, especially in our tool engineers who, with fellow engineers and scientists, are creating a better design for living. But let's not be conceited; we are merely a minority in a legion that strives for the same end. Anyway, it's so much easier to build a guy up than to tear him down. And, during the years that I've been writing this column, it's been my pleasure to build.

Not that I'm blind to human frailties, including my own, nor inclined to be meek even if lowly. Were someone to slap my face I might turn the other cheek, depending on how well I liked the slapper. But if he poked me in the nose—well, that's something else again. At that, I'd rather the other guy made the first pass, thereby leaving my conscience clear. But why lead with your chin when, as a matter of fact, there are few issues that can't be resolved by a meeting of minds. And that applies to nations as well as to individuals. When we begin to see the good in our fellows we'll stop making wars.

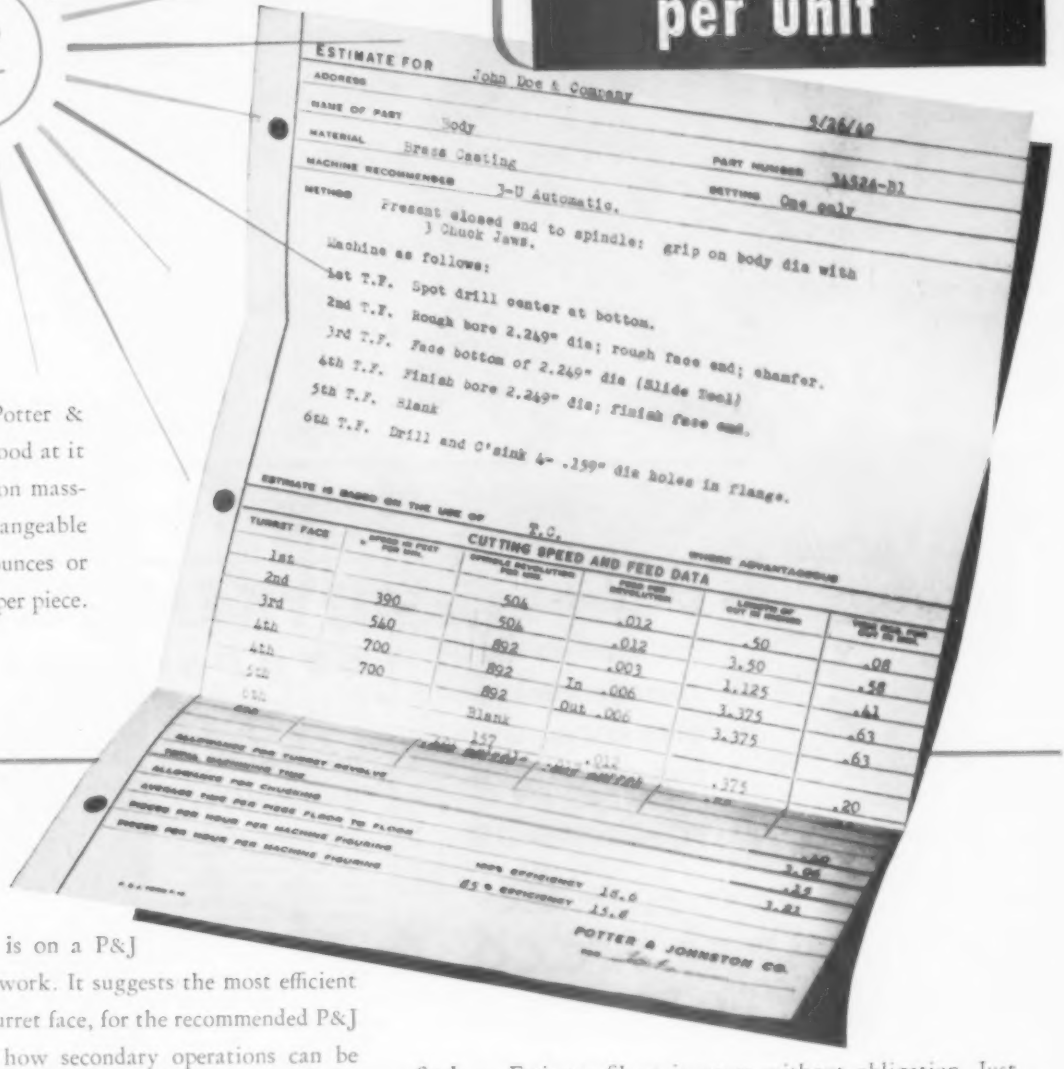
Andy

forecast

for better work

and more of it

at lowest cost per unit



If there is one thing Potter & Johnston engineers are good at it is tooling up for precision mass-production of interchangeable parts, whether a few ounces or several hundred pounds per piece.

Proof, if you want it, is on a P&J Estimate Sheet for *your* work. It suggests the most efficient tooling, turret face by turret face, for the recommended P&J Automatic. You'll see how secondary operations can be engineered into the main setup to reduce machining time . . . how unnecessary work-handling can be eliminated . . . how one man can operate two or more P&J Automatics, thereby gaining additional savings in divided labor costs. It forecasts the entire operation in actual cost-and-time figures.

Such an Estimate Sheet is yours without obligation. Just send in prints — better yet, a sample of the job itself.

Potter & Johnston Company

Pawtucket, R. I.

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P&J

P J AUTOMATICS...

t d for Production - Speed - Economy

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For your convenience, a key number follows the announcement of each product reviewed in the *Tools of Today* section of THE TOOL ENGINEER. To obtain complete information on any of these products, circle the corresponding key numbers on this coupon, and mail the coupon to THE TOOL ENGINEER.

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T-9-41

Name .....

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WHICH ONE? NAME YOUR SPINDLE

P-1

8" dia. wheel; housing dia. 3½", over-all length 15⅝", max. speed 6000 RPM.

P-32T

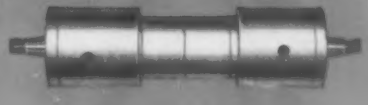
Direct Motorized Cartridge Type Grinder Spindle.

P-2500

from ¾ to 20 HP. Ask for Catalog 58.

INTERNAL

Internal Grinding Spindle for every requirement. Ask for new Catalog 57.

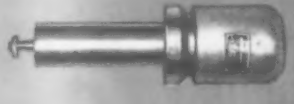


P-274

New belt driven Spindle for No. 2 Cincinnati Cutter Grinder.

P-666

Heavy Duty Wheel Head Spindle; over-all length 25⅜"; center height 3"; foot type housing 18⅜" long x 8¾" wide; max. speed 4000 RPM.



P-693

High cycle, 16,600 RPM, totally enclosed fan cooled 1 HP motorized spindle, over-all length 18⅜", barrel dia. 3".

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TRADE MARK REG. U.S. PAT. OFF.

builds into these Spindles the precision performance and long life that results in better work and more of it. Get the facts and figures on the one best Spindle for your job.

P-531

Boring Machine Spindle for Diamond or Carbide Tools; over-all length 20", center height 3", base 14⅝" x 8"; max. speed 5000 RPM.

P-5793

3, 5 or 10 HP, heavy duty deep hole grinding Spindle; 1800 or 3600 RPM; barrel dia. and length to specifications.

SPECIAL SPINDLES - *YOU* NAME IT

Send us your specifications for a quotation.

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Pope Machinery Corporation
261 River St., Haverhill, Mass.

Gentlemen:

Please send descriptive literature, specifications and estimates on the Pope Spindle types checked: P-1 ..... P-32T ..... P-2500 .....
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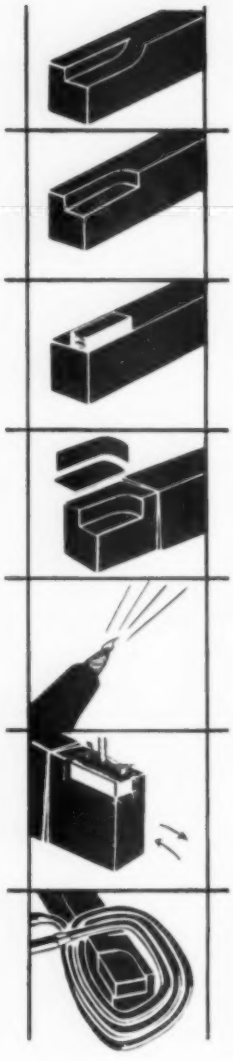
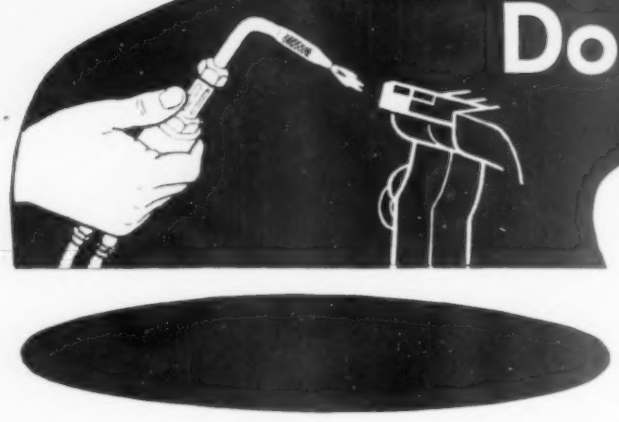
No. 62

Smart Carbide Users BRAZE & SAVE! Do You?





Are you taking advantage of the savings in money, time and headaches by brazing your own carbide tools with **ADAMAS TUNGSTEN CARBIDE?**

Brazing your own tools with durable **ADAMAS** carbide is simple, requiring no special equipment or technical knowledge.

How you save money— ★ Shank steel and **ADAMAS** carbide tips are inexpensive. ★ Increased use of present tool room facilities. ★ Preformed **ADAMAS** tips require little grinding with costly diamond wheels. ★ Maintain economical low level of finished tool inventory.

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Write for valuable free illustrated booklet "Braze and Save" to Dept. V

Convinced of the advantages and economy for carbide tool users, **ADAMAS** is concentrating on the job of maining the *fastest delivery schedule* of *quality* tungsten carbide *at lowest competitive prices.*

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GEAR PRODUCTION HIGHLIGHTS

No. 103

Cutting-Shaving-Checking-Lapping

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

15 to 1 Output Ratio on Shear-Speed vs. Hobber

A single Michigan Tool Shear-Speed gear shaper is currently turning out 130 five-pitch, 15-tooth, 3-inch diameter, ½-inch face gears per hour, approximately 15 times the production formerly obtained on the same part on a hobbing machine.

To obtain this production, all the teeth on four blanks are cut simultaneously, compared with six blanks cut on one arbor on the former hobbing machine setup.

Tool life is reported highly satisfactory with some 1200 parts being produced per grind. Since .010 to .012 inch is removed in sharpening the form tools, about 40 resharpenings are possible, for a total output of 48,000 gears per set of tools.

Fig. 1 shows the machine just after finishing a load of four blanks in around one minute cutting time. The operator is about to remove the finished gears. Fig. 2 shows four finished gears, four of the blanks from which they are cut, a Shear-Speed tool head as it looks from below, and one of the single point form tools used in the head.

To change tools, the head is lowered slightly, the tools are slipped out, and another set is inserted. Tools are sharpened by grinding the top face to master gage height on a surface grinder.

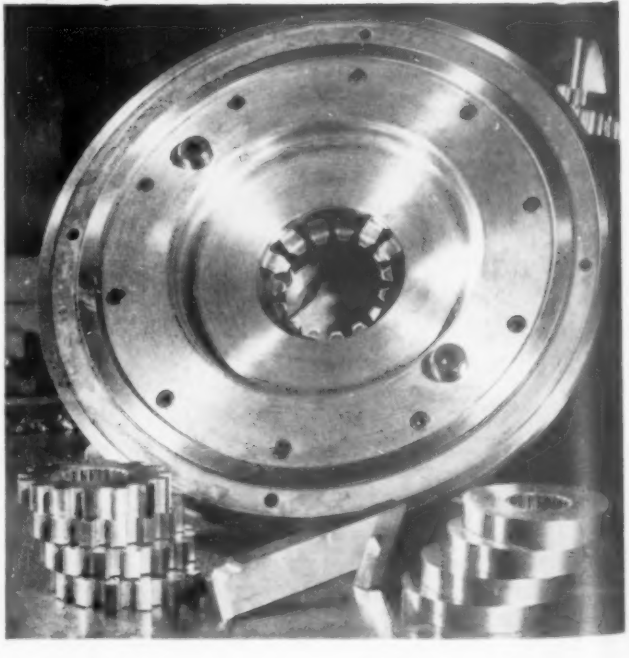
Practice is to remove a set of tools each day, or after each 1200 pieces, for sharpening. Theoretically, somewhat longer tool life per sharpening could be obtained. However, this would call for removing tools for grinding at irregular periods.

Material of the gear is SAE 1115, heat-treated after cutting. The part is used as a ratchet lock for a handbrake inside an automobile transmission.

For Shear-Speed machine details, write Michigan Tool Company for Bulletin SS-48-3.

Fig. 1 ↑

Fig. 2 ↓



Hot - but not bothered

RESIN BONDED

SPEED-WET METALITE® DISCS

Grinding heat can't affect the grain-grip of their resin bond. It retards loading, eliminates shedding, and keeps every grain cutting. Moreover, SPEED-WET METALITE Fibre Discs have a tough, all-fibre backing with the liveliness of spring steel. Get the extra "cutting mileage" of SPEED-WET METALITE Fibre Discs. They'll pay off every time.

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RESINALL METALITE® BELTS

They beat the heat in fast, continuous heavy-duty grinding. The heat-set resin bond can't melt, can't get "tacky," pick up chips, load or glaze. This belt cuts sharp and keeps on cutting sharp. There is 2 to 4 times more production with a RESINALL METALITE Cloth Belt. Try it out in your own shop — ask for a demonstration by a Behr-Manning Field Engineer.

New brochure on belt grinding and finishing — contains the latest information on stock removal, metal finishing, contour polishing, and other operations best performed on belt backstand set-ups. Send for your free copy today — use the coupon.

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Use NORTON® abrasives Sharpening Stones

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Please send me a copy of your new brochure on belt grinding and finishing.

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From 1.52 to .41 Minutes

This release bearing is a bronze casting which is bored, grooved, chamfered and faced on one side on a Sundstrand Automatic Lathe. It is one of 12 different sizes of parts run over this machine in lot sizes ranging from 500 to 5000 pieces. With the previous method for this operation, the time was 1.52 minutes. After changing the operation over to the Sundstrand, the time was reduced to .42 minutes. Comparable savings were obtained on the other sizes of parts run on this machine.

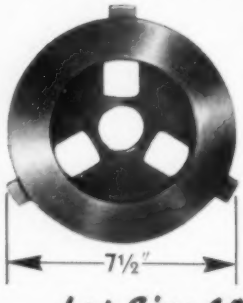
Lot Sizes 500 to 5000

From 5.02 Minutes to 1.7 Minutes

This steel drive shaft part was formerly turned on conventional equipment in 5.02 minutes. Processing in two operations on a Sundstrand Automatic Lathe reduced the time to 1.7 minutes (including prorated set-up time). This is just one of over 20 different sizes and types of shaft parts run on this machine in lot sizes ranging from 100 to 1500 pieces.

Lot Size 500

From 4.2 Minutes to 1.2 Minutes



The pressure plates are made of both steel and cast iron. They are made in several sizes and types, which are run in lot sizes ranging from 1000 to 3000 pieces. On the part illustrated, changing the operation to a Sundstrand Automatic Lathe increased production from 13 to 46 pieces per hour and reduced the time per piece from 4.2 to 1.2 minutes.

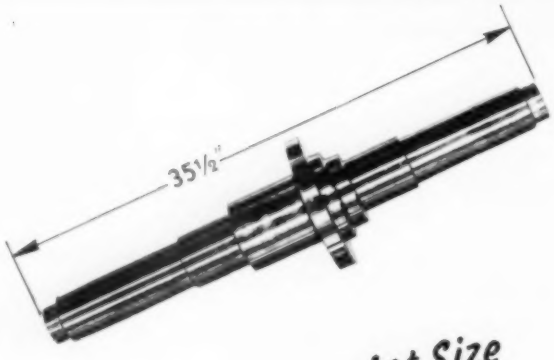
Lot Size 1000

Are You Losing TIME Turning Jobs Like These?

...Sundstrand Automatic Lathes Increase Production on both Short-Run and Mass Production Turning

These examples of time savings available from Sundstrand Automatic Lathes have been taken from the actual experience of only a few of the many of the users of this modern equipment.

All of the advantages of multiple-tool turning are available on *both* short-run and mass production work. Study these brief sketches and compare the production figures with parts similar to yours... then get the whole story for equivalent or better savings on turning work in your own plant.



Lot Size 950

From 23.7 Minutes to 3.82 Minutes

This track sprocket shaft is a 1045 steel forging with a hardness of 212 Brinell. It is completely turned in two set-ups on a Sundstrand 75 HP Model 16 Automatic Lathe, which has ample power to make full use of multiple tooling and carbide tipped tools. HP consumed at peak load is 84 — maximum depth of cut is ⅞". The reduced machining time, handling time and tool maintenance all added up to a production increase from 1.6 to 8 shafts per hour compared to former method.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

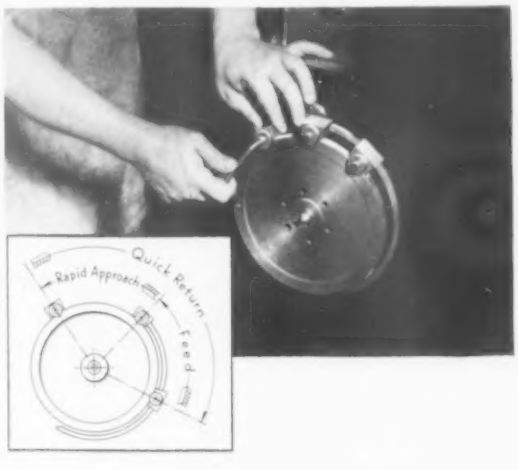
RIGIDMILS • FLUID SCREW RIGIDMILS • AUTOMATIC LATHES • HYDRAULIC EQUIPMENT

These Exclusive Features Make It Possible to Obtain This Higher Production

Seven machine design features govern the possibility of turning short-run work on Automatic Lathes otherwise limited to mass production turning only. They include (1) Wide range of carriage cycles, (2) Adequate feeds and speeds, (3) Quick cycle change, (4) Simplicity of adjustment, (5) Adequate power, (6) Automatic cycling and (7) High rapid traverse rate. Sundstrand Automatic Lathes have all seven. One of the most important of these is:

Quick Cycle Change for Faster Set-ups

Quicker set-up and easy change-over are possible because of the Sundstrand simple cycle control. This control eliminates making cams for every job to be turned. It provides complete control of all cycles by simple adjustment of dogs on a disc.



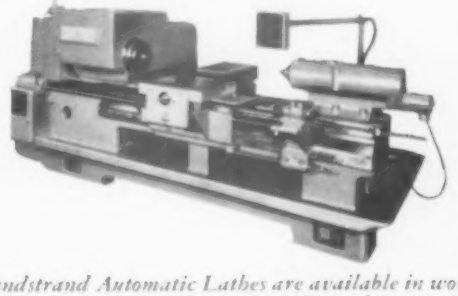
Another important feature is a:

Wide Range of Tool Action...

A wide range of action for front carriage tools is provided by three units, which can be used separately or in combination to give (1) Angular feed-in and tool relief, (2) Slow-up and dwell, (3) Straight feed-in and tool relief. Many combinations are possible by merely making simple adjustments.

Let Sundstrand Engineers Help You Select the Proper Automatic Lathe to Suit Your Work

Let our engineers assist in the selection of the proper automatic lathe for your job, and make tooling suggestions for faster turning of *both* short and long-run work. This competent staff of engineers is available to study your problems and suggest changes for increased production, lower costs. Send complete, accurate information with each inquiry.



Sundstrand Automatic Lathes are available in work capacities ranging from 5 to 75 HP and in varying speed combinations and lengths. Shown above is a 75 HP Sundstrand Model 16 Automatic Lathe.

Complete information on Sundstrand Automatic Lathes can be obtained from these booklets. Ask for bulletins No. 787.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS U.S.A.

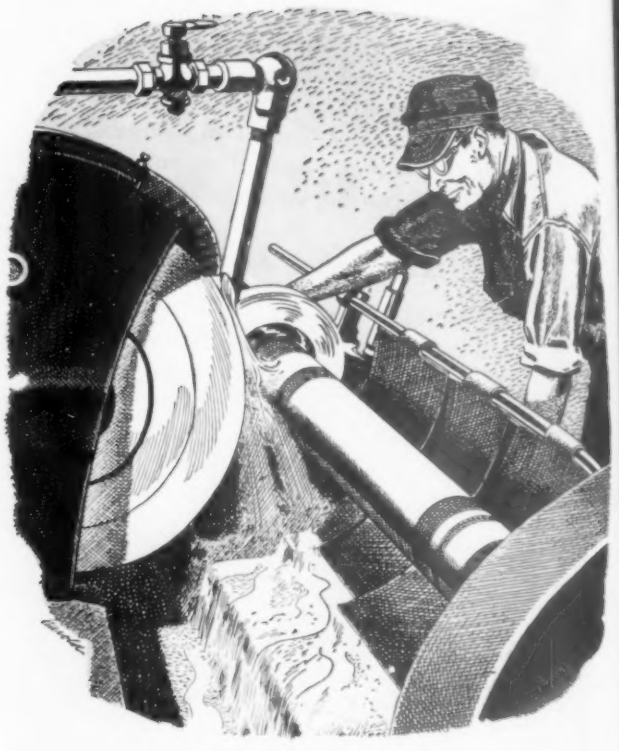
SUNDSTRAND
MACHINE TOOL COMPANY

2540 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES • SPECIAL MILLING AND TURNING MACHINES

A note on Abrasives

How Quality Control serves you every production hour



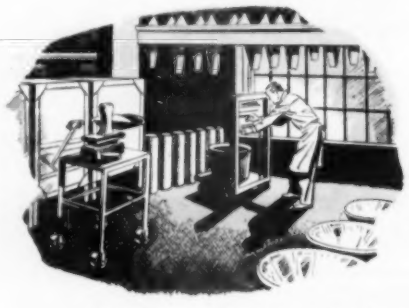
You can use and replace grinding wheel after grinding wheel... belt after belt... or disc after disc—depending upon the requirements of your work—and be sure that each replacement will continue to provide the same standards of abrasive performance. Your production continues on schedule.

These are the direct results of Quality Control in the production of abrasives by CARBORUNDUM. This control covers every step in the production of grain and the processing of belts, wheels, discs, and other abrasive products.

It assures abrasive particles of uniform grain size and classification. It guarantees that backings and bonds will perform as expected. Of primary importance, it assures consistent high quality and productive service in each abrasive tool. Because of our quality control, bonded or coated abrasives can be specified more exactly... and reordered, with confidence of dependable performance.

The continuation of efficient, high quality production is assured when you are using abrasives by CARBORUNDUM.

The Carborundum Company, Niagara Falls, New York.



The only complete line of Abrasive Tools is

CARBORUNDUM

TRADE MARK

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

Engineering News
ON ABRASIVE PRODUCTS

EFFECTIVENESS OF BACKSTAND BELT GRINDING

Used by a steadily increasing number of industrial plants and buffing and plating shops, the backstand belt grinding method offers practical production advantages and economies. It is particularly effective on operations ranging from rather heavy stock removal to the final polishing of surfaces preparatory to buffing. Consistently better finishes are obtained through the use of factory-coated abrasive belts. Units of work are completed in less time. The percentage of machine down-time is extremely low.

This increased efficiency has led to a 25% to 100% conversion to the belt backstand technique in plants which formerly used set-up wheels headed with abrasive grain.

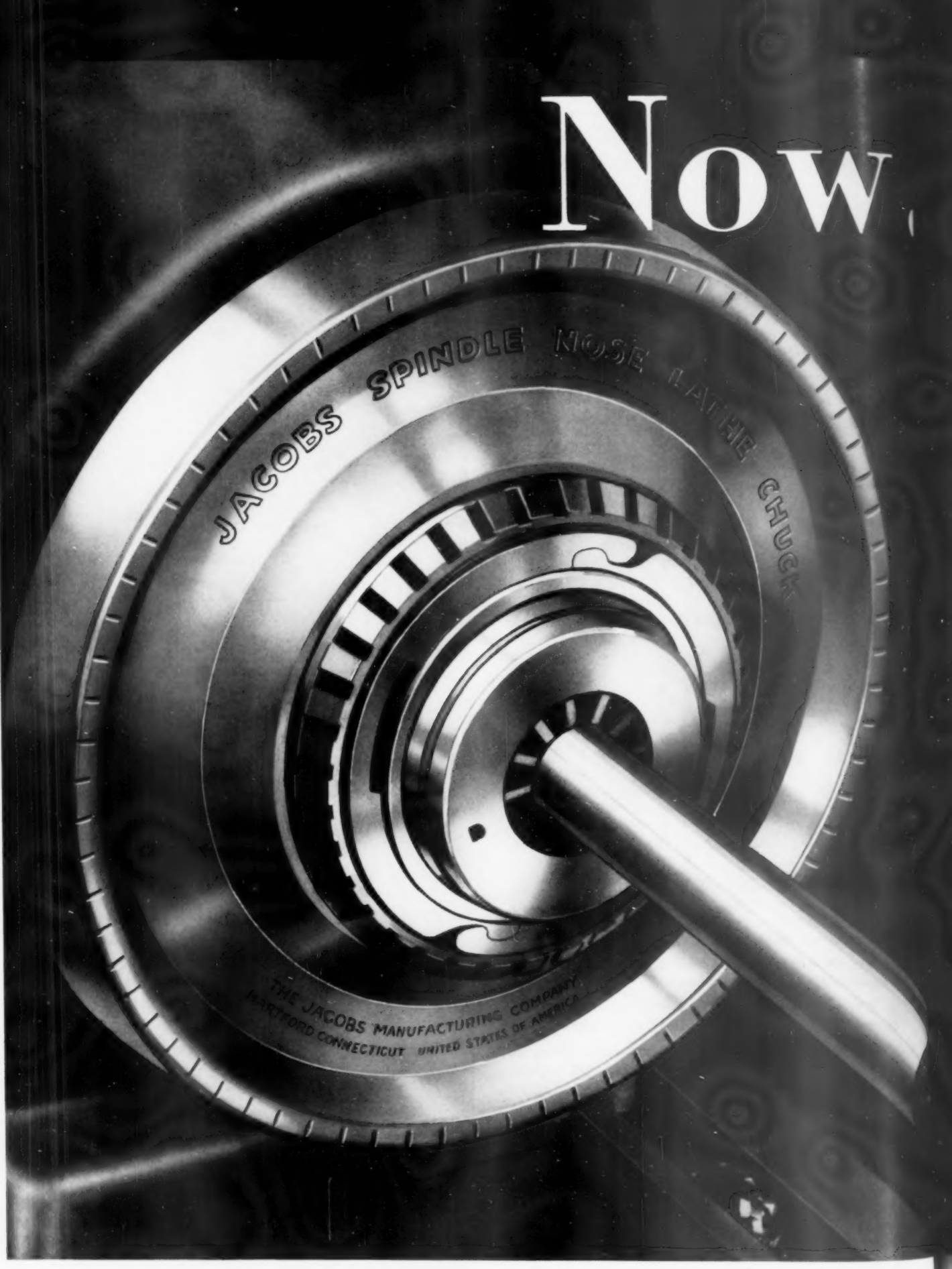
V20 BOND SEGMENTS

New V20 segments now make available a fast, cool, free-cutting abrasive for efficient, economical surface grinding applications. V20 segments are structurally uniform throughout; they perform with the same effectiveness during their entire life.

Because of their high degree of uniformity of structure, V20 segments incorporate greatly improved size holding characteristics and make possible the production of closely controlled surface finishes.

V20 segments offer the following advantages not found in competitive types of segments.

1. Cool and free-cutting qualities promote efficient production of burn-free finishes and close tolerances.
2. Uniform cutting qualities of V20 segments make possible close control of part size and finish and the establishment of controlled production rates.
3. Fast rates of cut obtained through the use of V20 segments save many dollars per year in operator and machine time on heavy production work.
4. More nearly self-dressing than other types, V20 segments offer savings in dressing time and usable abrasive.
5. Ability to grind a wide range of work of all sizes with larger table loads makes the surface grinder a more useful, efficient and profitable tool.
6. Successful use of V20 segments on nearly all types of metals including non-ferrous types makes possible reduced inventories in terms of gradings necessary for various types of work.
7. One grading can be used to grind a variety of materials successfully making it unnecessary to change segments when changing work thereby saving set-up time.



The new Jacobs Spindle Nose Lathe Collet Chuck. Introduced at the Chicago Machine Tool Show, now further refined and extensively field tested and proudly presented to you through Jacobs Distributors.

FOREMOST IN CHUCKS · FIRMEST IN GRIP ·

The *Jacobs* SPINDLE NOSE LATHE CHUCK

THE JACOBS MANUFACTURING COMPANY
West Hartford 10, Connecticut

If it's a JACOBS . . . it holds!

Jacobs brings you the most amazing Lathe Collet Chuck in machine tool history!

NO OTHER LATHE COLLET CHUCK CAN GIVE YOU ALL THESE ADVANTAGES:

SUPER ACCURACY . . . Precision built to deliver accuracy never before obtainable in collet equipment. *The most accurate collet chuck in the world today.*

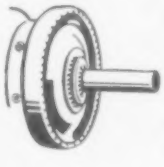
TREMENDOUS GRIP . . . Gives two to four times the gripping power of split steel collets. *You can now use the maximum speeds and feeds of the most modern tool room lathes — safely.*

AMAZING COLLET RANGE . . . Each collet has a full $\frac{1}{8}$" gripping range. *Eleven Jacobs Rubber-Flex Collets will chuck any bar between $\frac{1}{16}$" and $1\frac{3}{8}$"* . . . one collet does the work of eight.

EXTRA DURABILITY . . . The handwheel is solid aluminum and the forged alloy steel body is hardened and ground. All other parts of the chuck are of alloy steel, *hardened and ground throughout.*

NO FATIGUE . . . A unique impact mechanism allows rigid tightening and easy opening of the chuck *with a flick of the wrist.*

UNEQUALLED ECONOMY . . . You buy a chuck that will perform a COMPLETE job of chucking — *you save both on original investment and maintenance.*



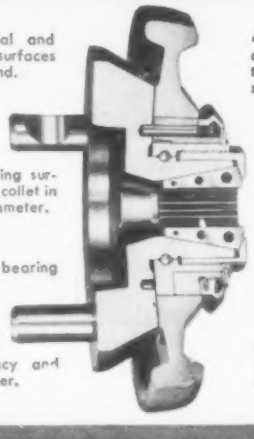
DEVELOPED BY JACOBS . . . This new Spindle Nose Lathe Chuck is a product of Jacobs' development engineers. *The Jacobs Manufacturing Company is the world's foremost producer of drill and tap chucks.*

SEE YOUR JACOBS DISTRIBUTOR — A special eight-page illustrated bulletin is available from your Jacobs Distributor.

1. All external and internal jaw surfaces precision ground.

2. Long bearing surfaces on each collet in relation to diameter.

3. Collet jaw bearing surfaces always parallel to and in full contact with work, assuring accuracy and gripping power.

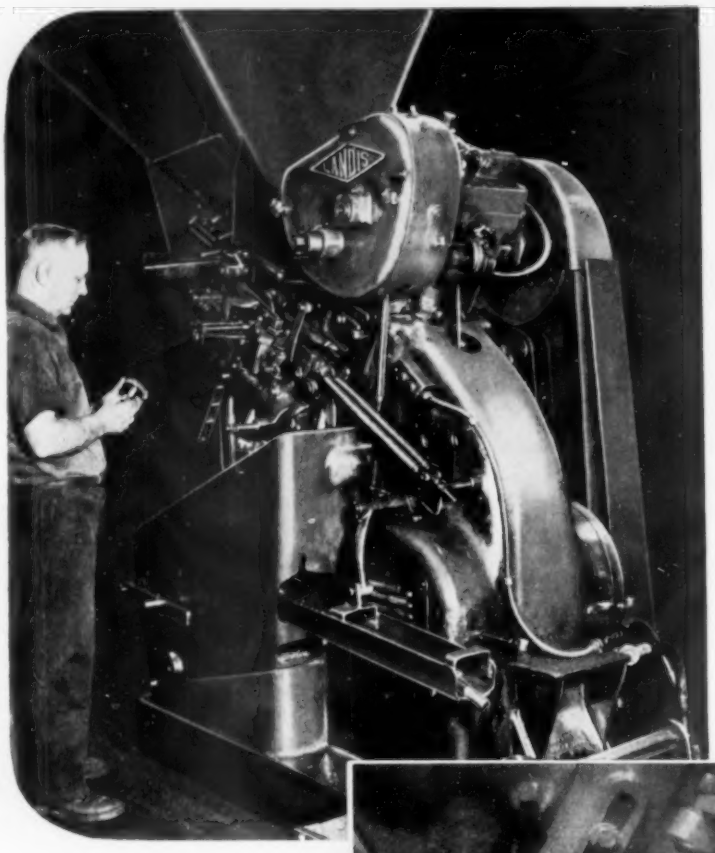


4. Rubber area of collet closes down on the work, completely sealing collet and chuck against entry of chips, dust, coolants, etc.

5. The compact design permits chucking close to the spindle nose. It allows a saving of 1" to $1\frac{1}{2}$" of overhang compared to the steel collet chucks now on the market.

Cutaway view of the chuck with collet in place.

In closing down the collet throughout the entire $\frac{1}{8}$" range, perfect parallelism is maintained between the extra long collet bearing surfaces and the work—accuracy and gripping pressure are constant. Unlike steel collets, no concession is necessary for spring temper and the alloy steel collet jaws are held to maximum hardness for long wear under rugged conditions. The rubber is permanently bonded and mechanically locked to the jaws, and is not affected by heat, coolants, or cutting compounds.



More Bolts..
PER HOUR, PER MAN

The LANDIS Automatic Forming and Threading Machine illustrated is a fully-automatic threading machine designed to point to length and thread bolts and cap screws from cold headed or hot forge blanks. It combines high production with low operating cost, and meets high standards of accuracy and safety. The machine is built with semi-vertical spindles to save space, and one man can easily service a battery of eight machines.

LANDIS TRADE MARK REG. U.S. PAT. OFF.

. . . . from 750 to 1800 bolts per hour!

• Bolt blanks are dumped continuously into the hopper (as illustrated). The operation is then automatic until the finished bolts are ejected into an oscillating conveyor carrying them to a container.

Short set-up time is ideal for short runs—a change in thread length in five minutes, in bolt length in 10 minutes, in speed in 2 minutes—a complete change in diameter, pitch, thread length, and bolt length in 40 minutes.

Output varies with bolt diameter and thread length—786 5/8" bolts in one hour, with more than 10,000 threads per chaser grind—more than 1,000 7/16" 20 pitch N.F. cap screws of alloy steel in one hour, to Class 3 specifications.

Write For Bulletin No. E-70

LANDIS MACHINE CO.
WAYNESBORO, PA., U. S. A.

Here's REAL Quality Control!

DO YOU HAVE this HANDBOOK?

We are referring to the 176-page book labeled "The Tool Steels of Allegheny Ludlum." It covers LXX, DBL-2, Super Panther, Deward, Saratoga, Huron, Ontario, Sagamore, Potomac, Pompton, Seminole, Utica, and other famous A-L grades. *Get your copy.*

Address Dept. TE-79

That block or bar or rod of quality tool steel you received from Allegheny Ludlum . . . had to run the gamut of our vigilance committee right up to shipment time. You probably weren't here to watch the technically planned mill procedure, the laboratory controls, and the inspections—but you can quickly appreciate the value of our dozen or more quality safeguards, once the steel goes into service.

Consider, for example, the supersonic reflectoscope. It's uncanny how that ferrets out any internal flaw.

This daily ritual of checking, testing, and inspecting at the various stages of production means that, in effect, we are operating our own "Bureau of Standards." By thus insuring quality, we protect you—the customer. You get better results.

For sound, clean, tool and die steels —uniformly accurate in analysis, structure, hardness, and size—call A-L.

ALLEGHENY LUDLUM
STEEL CORPORATION
Pittsburgh, Pa.

TOOL STEEL DIVISION: DUNKIRK, N. Y.

Fine Tool Steels Since 1854

AL

WSD 2492

AUTOMATIC LOADING permits you to turn out Precision Gears with unskilled operators at MAXIMUM PRODUCTION RATES

You as a gear manufacturer under present industrial and market conditions can correctly evaluate production equipment that:

❶ Assures extremely close gear tolerances consistently.

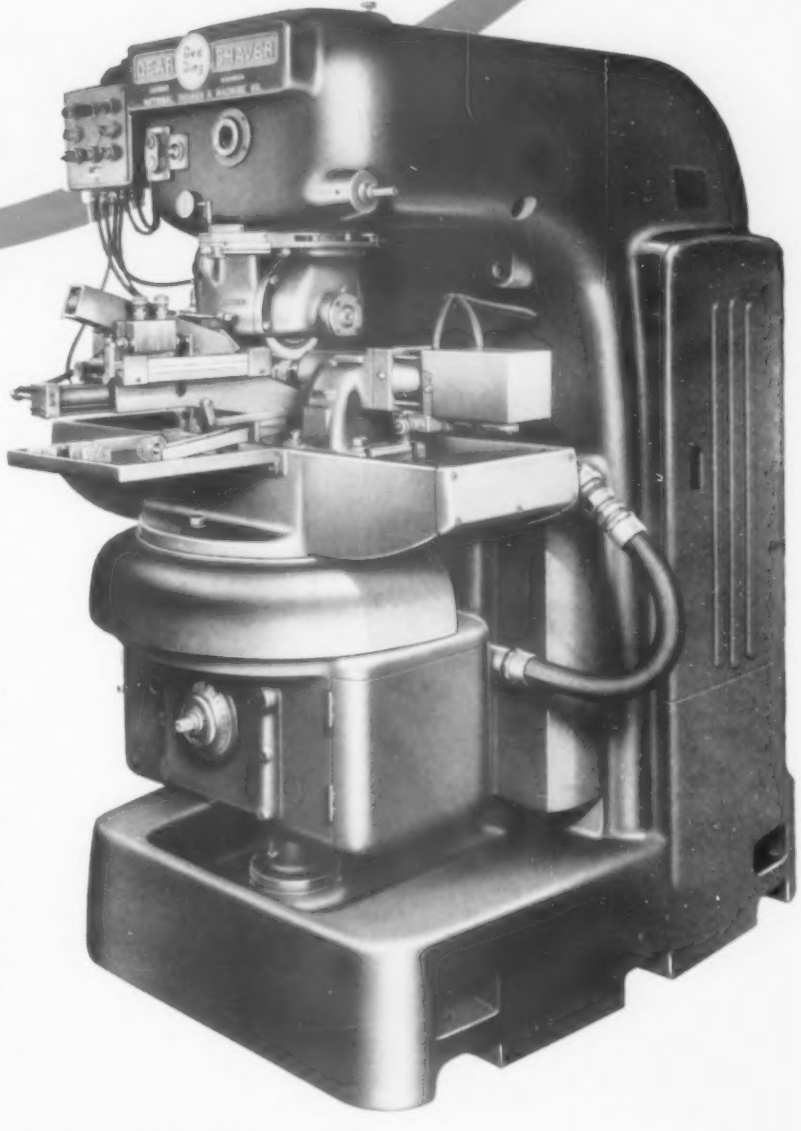
❷ Does not require any mechanical skill to operate.

❸ Eliminates operator fatigue and its effect on morale.

❹ Operates continuously at mass production speed.

That is precisely what you can have with Red Ring Automatic Loading in connection with Gear Shaving Machines GCU or GCV.

Either of these machines so equipped can be run continuously merely by keeping a supply of work gears in the magazine and removing the finished gears. One operator easily serves a battery of machines, for the entire machining operation is entirely automatic.



Production rates are phenomenal. Write for descriptive literature.

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

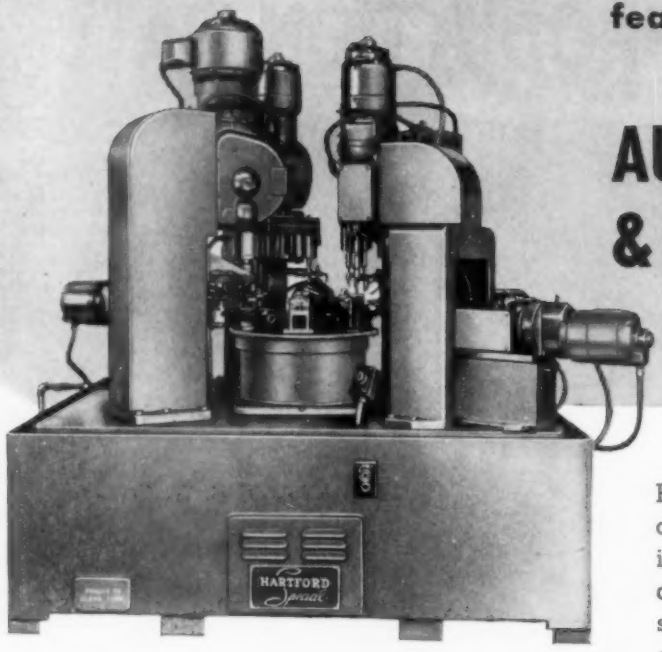
Make every operator an expert

with "Packaged Engineering"

featured in all Hartford Special

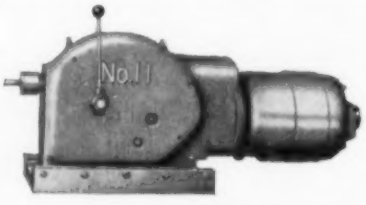
"LANGELIER"

AUTOMATIC DRILLING & TAPPING MACHINES

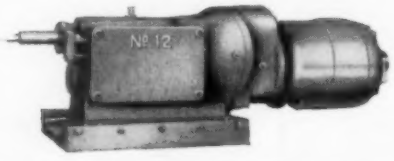


This machine does 15 facing, drilling, reaming and tapping operations on a small part. Multiple spindle heads are used on some drilling and tapping units to accomplish two or more operations at a station.

Automatic Unit
No. 11 & 31



Lead Screw
Tapping Unit
No. 12 & 22



The spindles of all units are of alloy steel, heat treated and ground, mounted in anti-friction bearings. All gears are of heat treated alloy steel. Dovetail adapter plate with screw adjustment permits quick and accurate positioning.

Hartford Special Drilling and Tapping Machines are scientifically engineered to do all the "thinking" necessary to produce the finished pieces on a specific job. The operator's part is reduced to starting and stopping the machine, and loading and unloading the parts. Since his skill is not a factor, the finished pieces are of uniform accuracy and the high production rate is automatically maintained. The sequence of operations such as drilling, tapping, counterboring, milling, reaming, spotting, chamfering etc., is designed to require the minimum of time, space and maintenance. If your job requires a special single-purpose machine, it will be worth your while to investigate the "packaged engineering" Hartford Special has to offer. Why not write our Engineering Department now. The Hartford Special Machinery Co., Hartford 5, Connecticut.

HARTFORD Special

...the standard for special machinery

THE GREENFIELD STORY
of Service and Quality

"Gun"

CHIPS clogging in the flutes of taps are the No. 1 cause of breakage. This happens particularly when the metal is "stringy" and the tap is being used in a machine operating at high speeds.

"Greenfield" engineers licked that problem years ago in through hole tapping by inventing a tap that shot the chips out ahead as it cut a thread. *They named it the "Gun" Tap.* The advantages are many. The body of the tap can be thicker and stronger. The shearing action of the tap takes less power. And the threads are more accurate.

Perhaps you have been using "Gun" Taps for years and this is an old story to you. If not, you may be interested in learning more about "Gun" Taps from your local "Greenfield" Distributor or by writing direct to "Greenfield".

GTD

GREENFIELD TAP and DIE CORPORATION
Greenfield, Massachusetts

and

GEO MET RIC

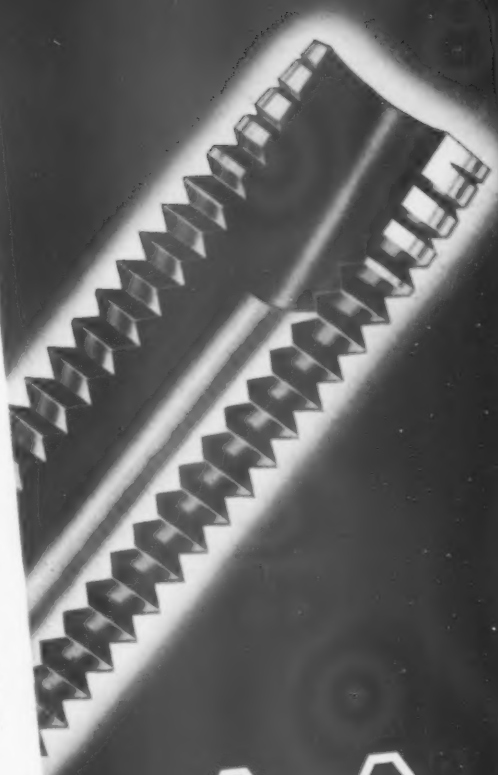
THE GEOMETRIC TOOL CO.
New Haven 15, Connecticut

and

GTD AMPCO

AMPCO TWIST DRILL CORP. ★
Jackson, Michigan

Divisions of Greenfield Tap and Die Corporation



GTD

GREENFIELD

Be Sure
Buy "Greenfield"

*Since July 1, the operations of Ampco Twist Drill Corporation have been merged with Greenfield Tap and Die Corporation at Greenfield, Mass.

Precision THREADING TOOLS

Solid Adjustable

Class SJ Tap and Chasers

Where the time for backing out is unimportant, or where space is limited the SJ Tap is recommended.

★ ★

Available in eleven sizes with a cutting range from 1 5/16" to 8½".

★ ★

GEOMETRIC also makes a complete line of Rotary and Stationary Self Opening . . . and Solid Adjustable Die Heads—and Collapsing Taps—and GEOMETRIC Chasers.

"Be Sure . . . Buy Geometric"

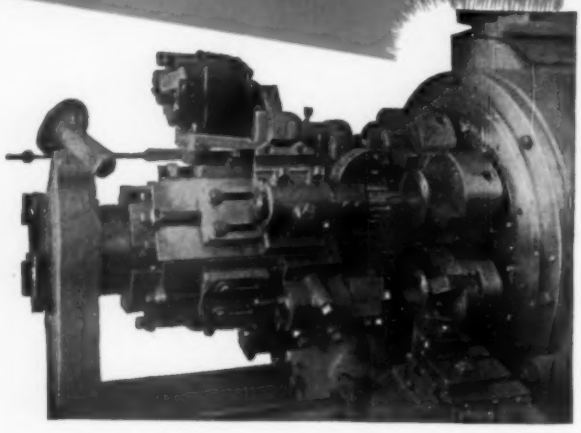
THE
GEOMETRIC
TOOL COMPANY, NEW HAVEN 15, CONNECTICUT

GTD

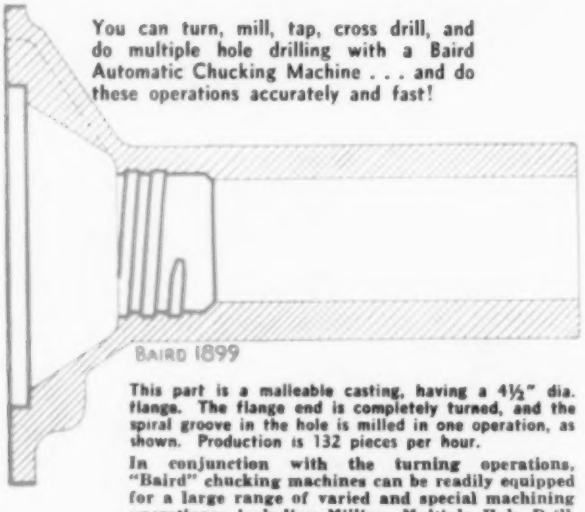
GTD AMPCO

versatility

COMPLETE TURNING PLUS MILLING OPERATIONS ARE READILY ACCOMPLISHED ON BAIRD AUTOMATIC CHUCKING MACHINES



You can turn, mill, tap, cross drill, and do multiple hole drilling with a Baird Automatic Chucking Machine . . . and do these operations accurately and fast!



This part is a malleable casting, having a 4½" dia. flange. The flange end is completely turned, and the spiral groove in the hole is milled in one operation, as shown. Production is 132 pieces per hour.

In conjunction with the turning operations, "Baird" chucking machines can be readily equipped for a large range of varied and special machining operations: including Milling, Multiple Hole Drilling, Tapping, Cross Drilling, etc.

When you have turning operations that must be done profitably:

ASK BAIRD ABOUT IT

Write us for complete specifications of the many Baird Automatic Chucking Machines.

THE BAIRD MACHINE COMPANY
STRATFORD, CONNECTICUT

M-T FIXTURE CLAMPS AND COMPONENTS

BE DOUBLY SURE with M-T QUALITY

FIXTURE CLAMPS — wide range of sizes and types to fit every requirement.

Jack Locks . . . Cam Locks . . . Hand Knobs . . . Hand Wheels . . . Steel Ball Handles . . . Soft Chuck Jaw Blanks . . . Fixture Cams . . . Alloy Set-up Studs . . . Rest Buttons and Rest Pads . . . Spherical and Plain Collar Nuts . . . Quarter Turn Screws . . . Fixture Keys . . . Spherical and Flat Washers . . . Shoulder Screws and many other items from stock.

MORTON MACHINE WORKS

2420 Wolcott St. Detroit 20, Mich.
WRITE FOR COMPLETE CATALOG

Here's the Answer to Binding, Breakage, Chatter, Stripped Threads, Dangerous Strains, Loosening, Leakage and Squeaks.

All these common faults are minimized or eliminated by modern product *quality control*—STURTEVANT torquing at critical points. STURTEVANT TORQUE Wrenches are *permanently accurate*. Because of their inherent design they cannot become inaccurate. Capacities from 0-8 in. oz. to 0-7200 in. lbs. Both inspection and high speed production types.

Write for Bulletin SW-41

Sturtevant Sensory TORQUE WRENCH
HEAR-FEEL-SEE

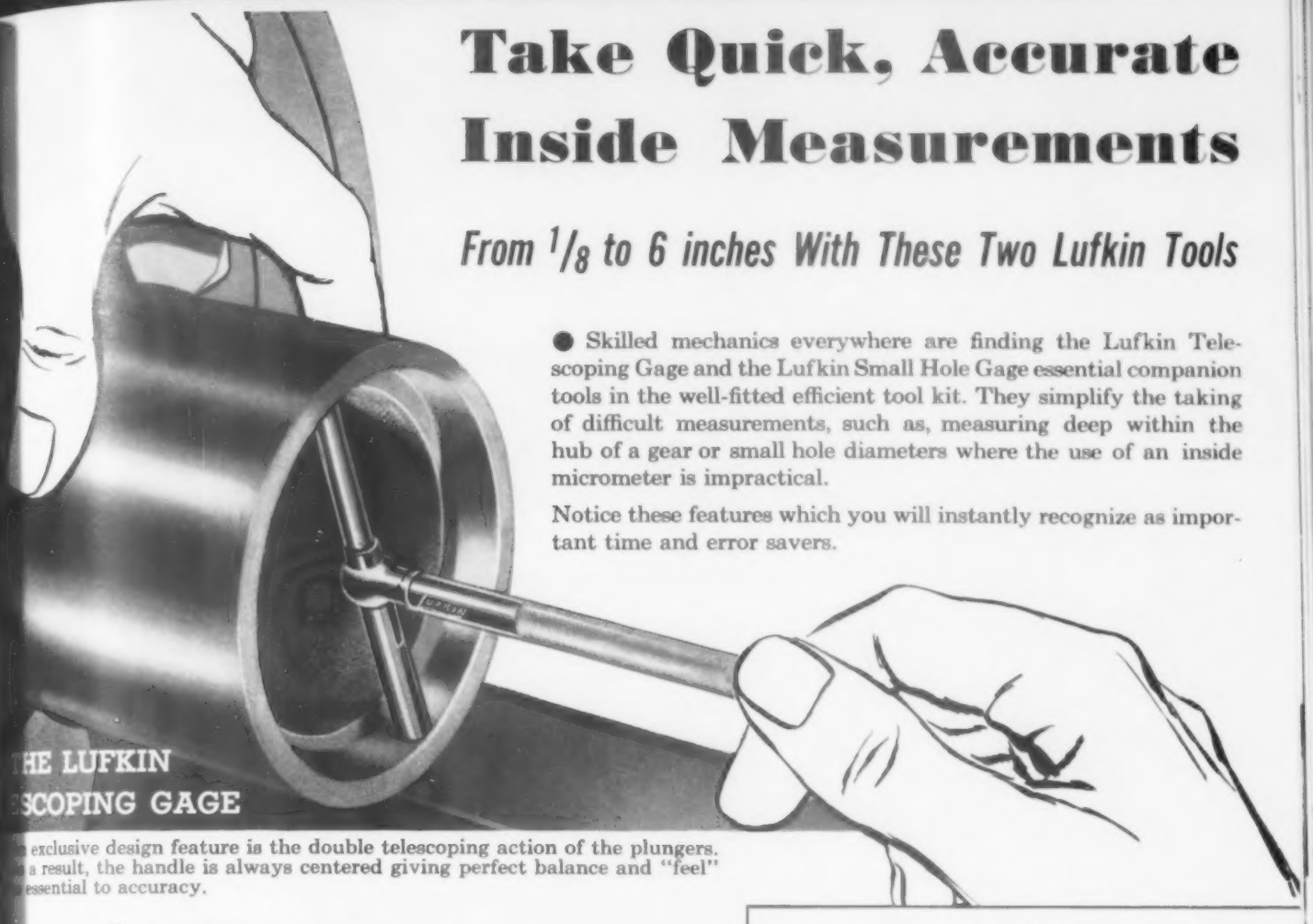
P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Take Quick, Accurate Inside Measurements

From 1/8 to 6 inches With These Two Lufkin Tools

● Skilled mechanics everywhere are finding the Lufkin Telescoping Gage and the Lufkin Small Hole Gage essential companion tools in the well-fitted efficient tool kit. They simplify the taking of difficult measurements, such as, measuring deep within the hub of a gear or small hole diameters where the use of an inside micrometer is impractical.

Notice these features which you will instantly recognize as important time and error savers.



THE LUFKIN
SCOPING GAGE

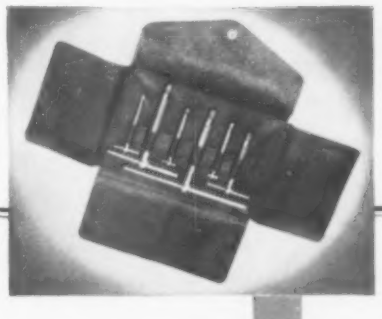
exclusive design feature is the double telescoping action of the plungers. a result, the handle is always centered giving perfect balance and "feel" essential to accuracy.

LUFKIN Telescoping Gages and

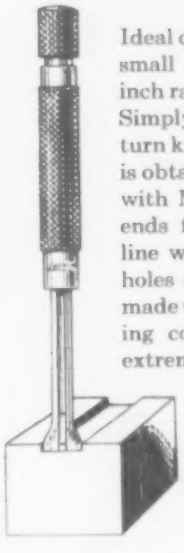
easurements down to one ousandth inch or less are taken m the gage with a Micrometer.

Each gage has its own handle sized in direct proportion to its plunger range, assuring perfect balance found in no similar gage.

Available individually or in sets packed in a durable leatherette case. Range 5/16 to 6 inches.



New Small Hole Gages



Ideal companion tool for measuring small holes or slots below the 5/16 inch range of the Telescoping Gage. Simply insert ball end in hole—turn knurled knob until right "feel" is obtained—then measure ball end with Micrometer. Gages have ball ends flattened off close to center line which permits gaging shallow holes or grooves. Provision is also made whereby travel of the expanding cone is stopped at both the extreme open and closed limits of the gage preventing breakage. Available individually in four different sizes, or as a complete set with range of 1/8 to 1/2 inch.

e Dept. TE for nating booklet, e Amazing Story easurement." En- 10c (no stamps) over handling mailing.

THE LUFKIN RULE CO.

Saginaw, Michigan • New York City • Windsor, Canada

Buy LUFKIN

PRECISION TOOLS • TAPES • RULES

FROM YOUR DISTRIBUTOR

GEAR SHAPER
SHAVING MACHINE
THREAD GENERATOR
CUTTERS AND SHAVING TOOL
GEAR INSPECTION INSTRUMENT

•

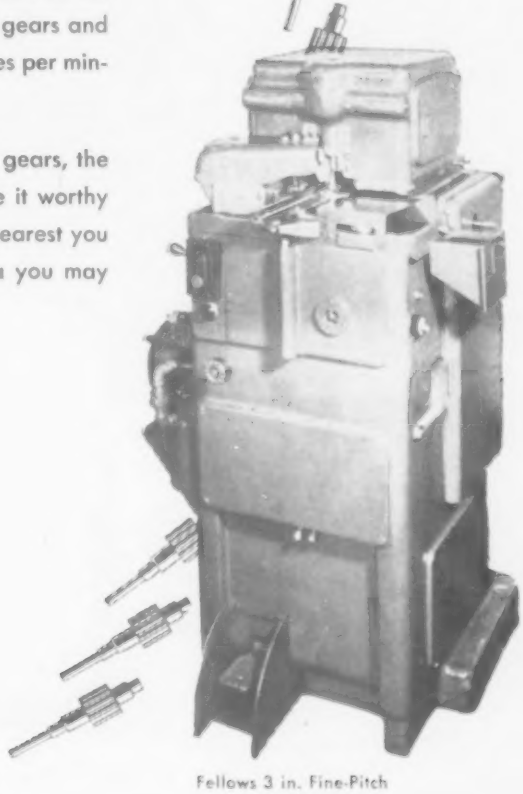
PLASTICS MOLDING MACHINE

5,000 finished pinions in 8 hours

Performance like this is typical of the Fellows Method applied to small gears and pinions. Faster output than sub-press dies. Higher accuracy, finer finish, and up to 64, 80 or even 200 pitch. That's the cost-saving story on this "small gear speedster" of the Fellows Line—the No. 3 Fine-Pitch Gear Shaper.

With magazine feed and automatic work ejection it can be set up for record production on a wide variety of small gears and pinions. Cutter speeds may be set at up to 2000 strokes per minute depending upon the work.

Whatever your present method of turning out small gears, the production possibilities of this Fellows machine make it worthy of investigation. An inquiry addressed to the office nearest you will bring descriptive literature, or any special data you may request.



Fellows 3 in. Fine-Pitch Gear Shaper

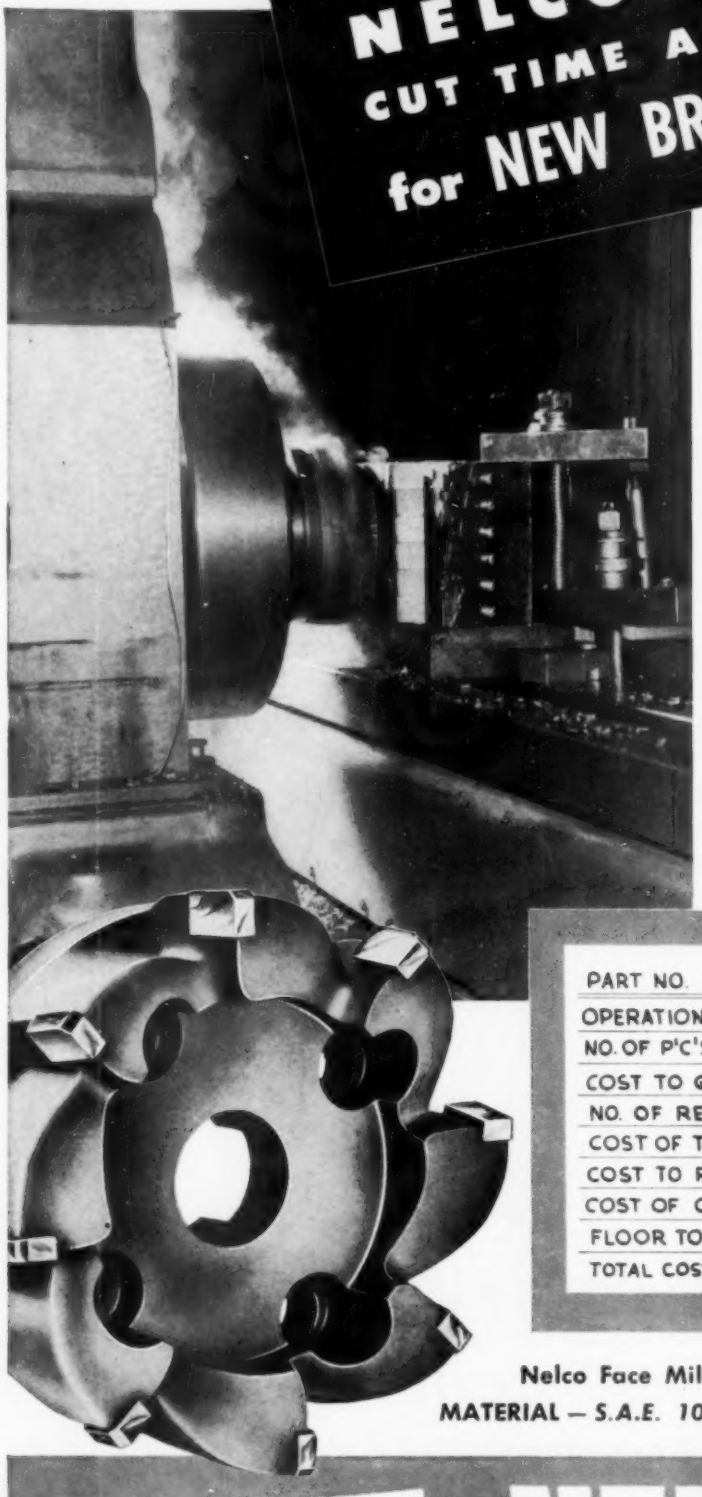
Fellows

THE FELLOWS GEAR SHAPER COMPANY • Head Office and Export Department • 78 River Street, Springfield, Vermont

Branch Offices: 616 Fisher Bldg., Detroit 2 • 640 West Town Office Bldg., Chicago 12 • 7706 Empire State Bldg., New York 1.

Here's how

NELCO FACE MILLS CUT TIME AND REDUCE COSTS for NEW BRITAIN MACHINE CO.



Milling the Forming Slide Cam blanks for New Britain-Gridley Model 60 six-spindle automatic Bar Machines is done six at a time with the No. 8106F Nelco Face Mill with carbide tipped blades.

The time and cost analysis chart shows the comparative savings effected by Nelco carbide tipped cutters over the tools formerly used. This is only one of many New Britain Parts which are milled efficiently with Nelco Tools.

PART NO. A 407-1782	NAME Forming Slide Cam blank	
OPERATION 110 mill end	CARBIDE	HIGH SPEED
NO. OF P'C'S. PER GRIND	400	100
COST TO GRIND	$7.50	$3.75
NO. OF REGRINDS	8	10
COST OF TIPS	$8.00	$16.20
COST TO RETIP & GRIND	$16.00	$6.00
COST OF CUTTER PER PIECE	$ .024	$.054
FLOOR TO FLOOR TIME	1½ min	3½ min
TOTAL COST TO MILL ONE P'C.	$ .144	$.394

Nelco Face Mill No. 8106F . . . SPECIFICATIONS

MATERIAL — S.A.E. 1045 GAS CUT SPEED — 500 R.P.M. FEED — 15" P.M.

WRITE for descriptive literature and name of your Nelco Distributor.

NELCO TOOLS

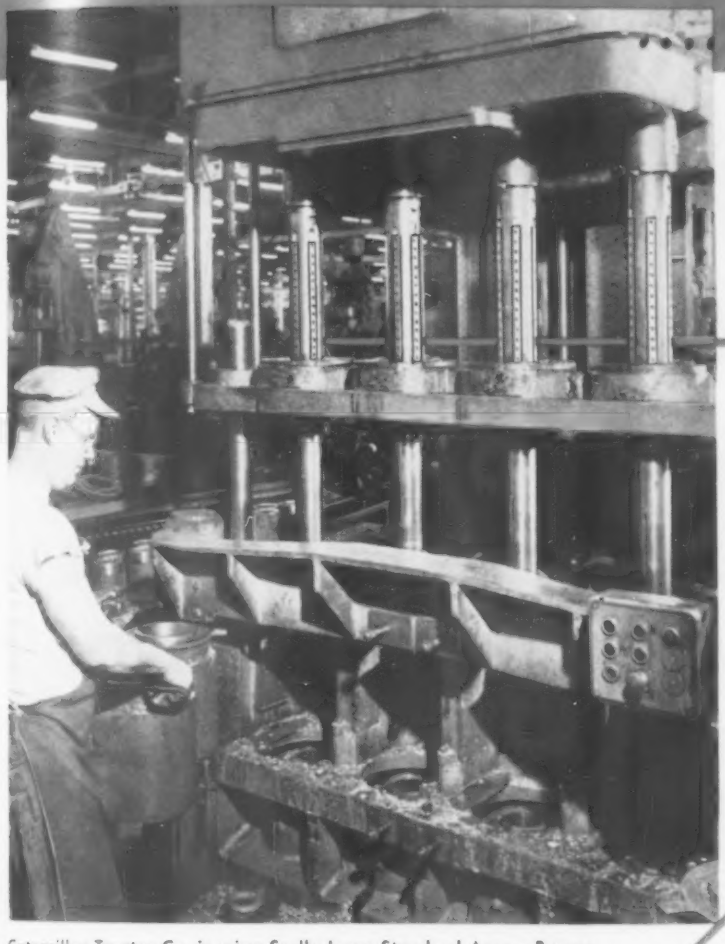
For that extra edge in production

NELCO TOOL CO., INC., Manchester, Conn.

REDUCE WEAR

. . . on BARS and BUSHINGS

. . . . like "Caterpillar" does



Caterpillar Tractor Co. is using Scully-Jones Standard Ampco Bronze Wear Strips as shown here, to reduce upkeep cost on bars and bushings used in boring lines, and to maintain full production.

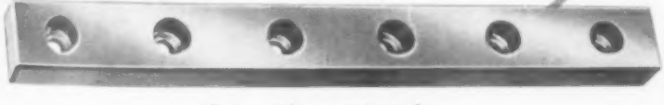
with

S-J SCULLY-JONES

STANDARD AMPCO

BRONZE WEAR STRIPS

- ***Reduce Seizing and Galling***
- ***Save Wear on Bars and Bushings***
- ***Maintain Continuous, Accurate Cutting Operations***
- ***Cut Down-time, Maintenance and Replacement Costs***



Top and bottom view of
Scully-Jones Standard Ampco Bronze Wear Strips.

Use these wear strips on your boring bars and driving tools, wherever friction, galling or wear are serious factors. They are easy to attach, adjust or replace.

S-J Standard, 6-Hole Type, Ampco Bronze Wear Strips are furnished in 5 sizes that meet all requirements. Available for Immediate Delivery from stock.

SEND FOR New Descriptive BULLETIN Containing Prices and Specifications

Scully-Jones AND COMPANY

1915 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

R3362

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

The first operation is broaching the four surfaces of the king pin bosses, which are broached on a Standard *American* SB-66-25 hydraulic single ram machine. Part is located from fixed locating blocks under the bosses, and on the rough spindle end with floating Vee block. Fixed to the machine ram is a manually operated equalizing mechanism that equalizes part prior to clamping action.

FOUR MAJOR PRODUCTION OPERATIONS

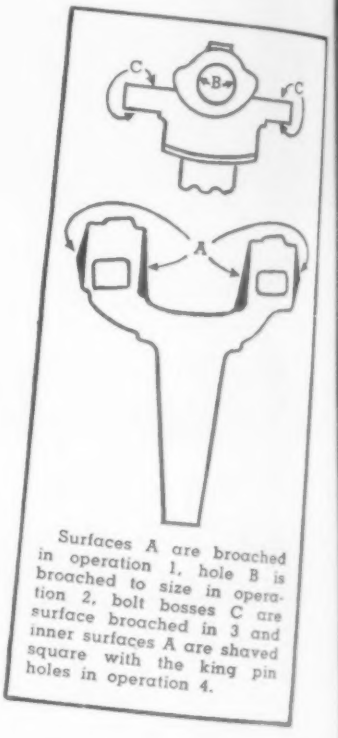
on truck steering knuckle bosses

performed by *American* BROACHING MACHINES

Broaching eight flat surfaces and a king pin hole in truck steering knuckle bosses brought maximum production economy to the midwest plant of a leading truck and farm equipment manufacturer. The four machining operations are listed in broaching sequence below:

1. Inside and outside surfaces of king pin hole bosses surface broached on an *American* SB-66-25.
2. King pin hole broached to size using an *American* VP-3-10-30.
3. Top and bottom surface of bolt bosses broached to size on an *American* SB-48-15.
4. Inside face of bosses finished shaved square with hole on an *American* V-2-6 Ton Press.

This set-up is excellent evidence of the versatility of *American* Broach engineering. Perhaps you have a production step where one or more broaching operations can reduce costs — step up production. Write to *American Broach*, Dept. T, for information and descriptive circular. No obligations, of course.



Surfaces A are broached in operation 1, hole B is broached to size in operation 2, bolt bosses C are surface broached in 3 and inner surfaces A are shaved square with the king pin holes in operation 4.

AMERICAN *American* BROACH & MACHINE CO.

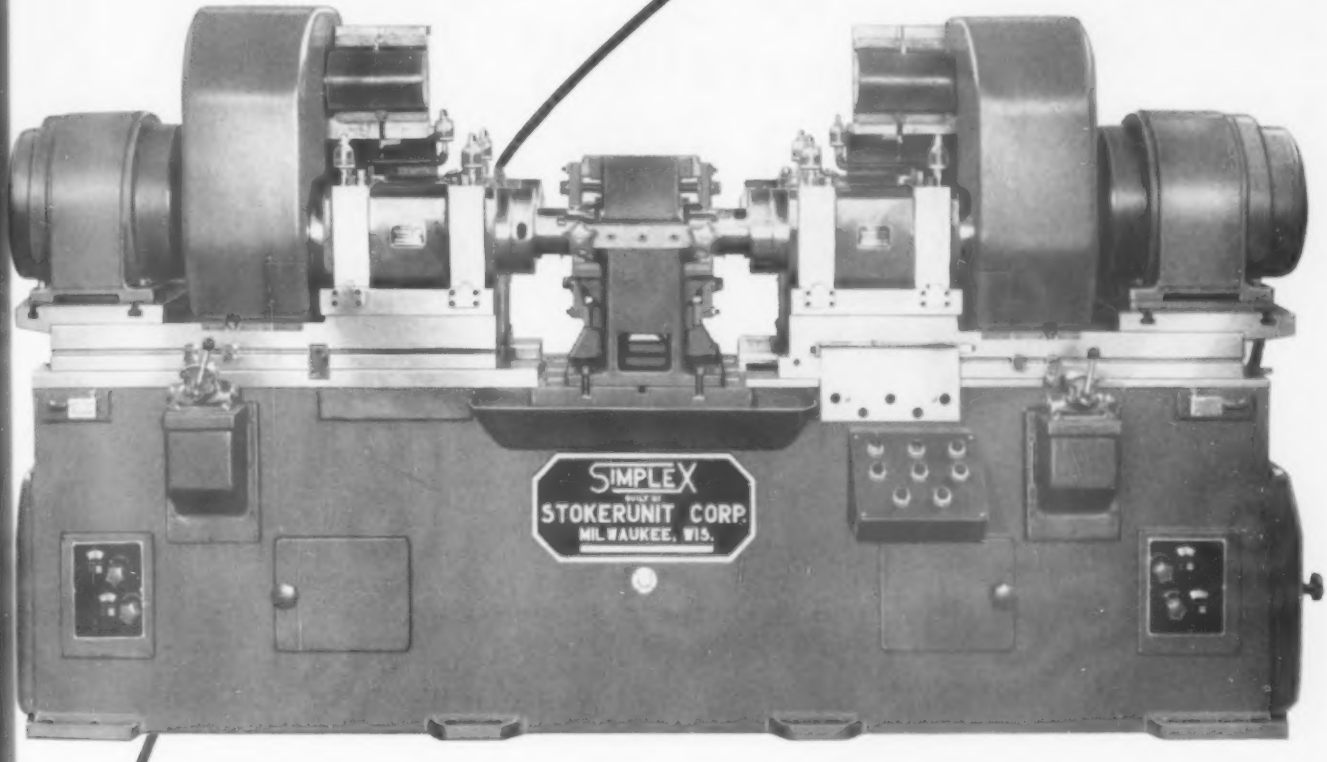
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

ANN ARBOR, MICHIGAN

See *American* First—for the Best in Broaching Tools, Broaching Machines, Special Machinery

SIMPLEX

DIESEL ENGINE CONNECTING RODS are difficult to bore to modern standards of accuracy and finish. Here, in one machine, all rough and finish boring, facing and chamfering operations are performed in minimum time.



The machine is a SIMPLEX 3U 2-way Precision Boring Machine with left-hand table mounted on hardened dovetail ways for rough boring, chamfering and facing one side of both ends. The piece is then reloaded on the right side of the fixture. The right-hand unit finish bores, chamfers and faces the other side. Heavy precision boring spindles, with powerful drives from 7½ HP motors, provide excellent finish and accuracy at low unit cost.

PRECISION BORING MACHINES

SIMPLEX MACHINE TOOLS DIVISION

STOKERUNIT CORPORATION

4528 West Mitchell Street

MILWAUKEE, WISCONSIN

Precision Boring Machines, Planer Type Milling Machines, Special Machine Tools

YOU CAN CUT OFF LARGE STOCK *More Cheaply, Quickly and Efficiently*

with the MOTCH & MERRYWEATHER Segmental Type

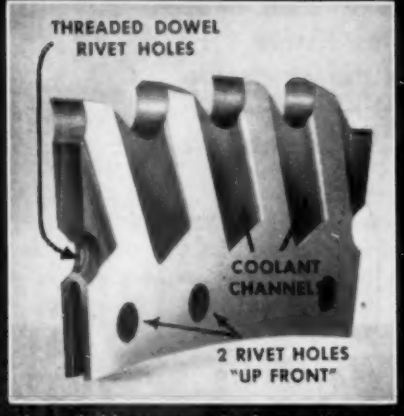
Triple-Chip Saw Blade

Triple-Chip saw blades of the segmental type from 11" through 70" diameter are recommended by Motch & Merryweather for cutting larger stock, because they produce faster cutting and smooth finish. Re-sharpening of segments permits many cuts per segment, and replaceability of segments makes possible continued use of the same disc... For most satisfactory results, use Motch & Merryweather blades with Motch & Merryweather circular sawing machines for cutting off stock up to 16½" diameter.

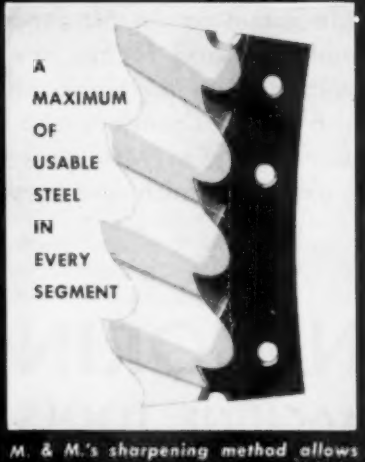
Ask for Bulletin 200-T

THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO

M. & M.'s exclusive Triple-Chip grind gives unrivalled efficiency. Alternate high and low teeth form one and two curling chips, respectively ("Hi-Lo" principle).



Rivets hold segment firmly to disc and overcome cutting pressure. Threaded dowel rivets maintain alignment. Coolant channels carry lubricant to cutting edges.

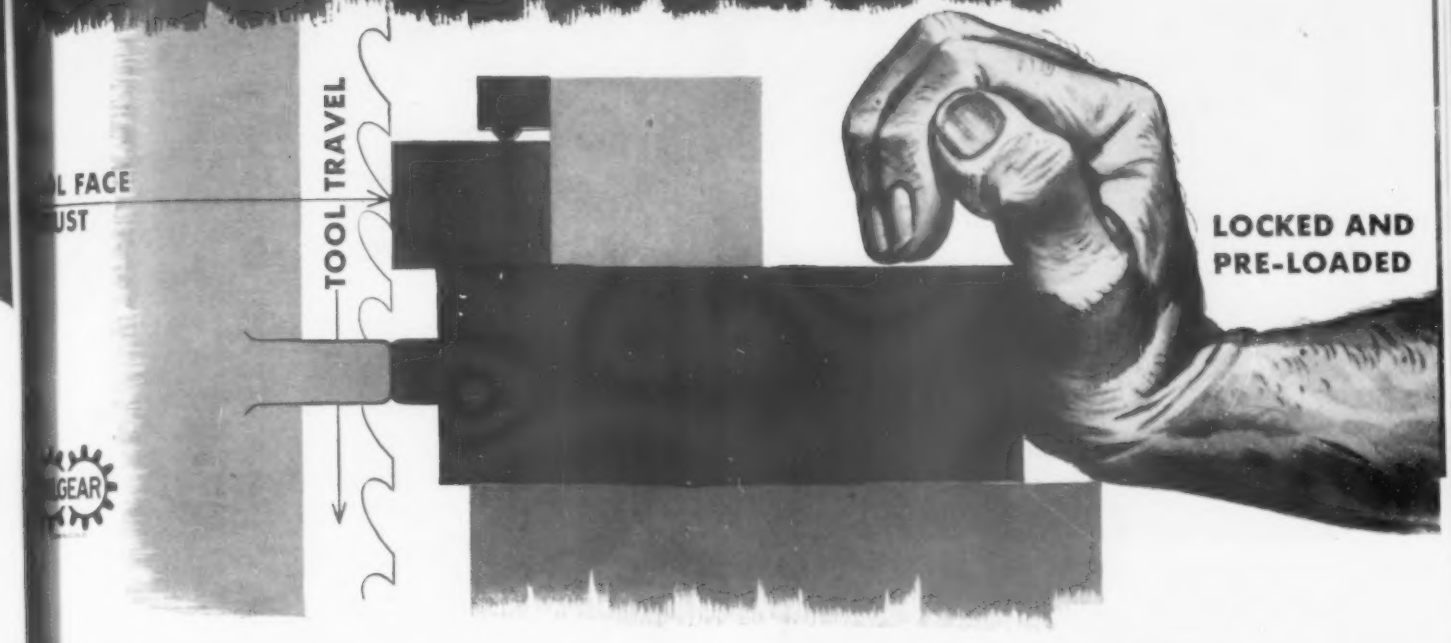


M. & M.'s sharpening method allows maximum number of cuts per blade. Blade can be re-fitted with new segments repeatedly without reducing diameter.

Tongue-and-groove construction insures exact fit. Projecting segments protect disc. Taper side clearance provides free cutting throughout life of segment.

AT YOUR COMMAND • AN UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

k Tables



broached parts are not being finished to consistently close ces and flat surfaces, it is evident that the table operating ding mechanisms on your broaching machines are yielding face angular thrusts. It is equally obvious that *NO* table is *NOT* pre-loaded and thus rigidly held in broaching posi- withstand these forces without deflection.

is a broaching problem which Oilgear has solved with its d and exclusive work table shuttling mechanism which cks and *pre-loads* the tables in broaching position. Under nnage tool face thrust there is no measurable table deflec- arts are held firmly in broaching position and do not yield ing broaching tool forces. Consistently close tolerances e flat surfaces are easily maintained.

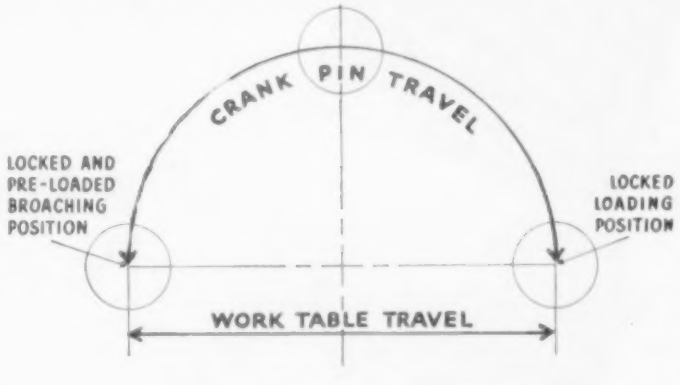
INTERLOCKED TABLE MOVEMENTS

work table movements are *interlocked* hydraulically, lly and, in the double slide machines, also mechanically, tive sequence operation with tool slide. *No cycle mal- ning is possible.* There are no valves to constantly r maintain. There is no complicated switch arrangement t or maintain. For the table interlock, Oilgear uses only it switch, only *one* relay.

HARMONIC TABLE MOTION

fluid power, direct ram-actuated, heavy-duty crank sm shuttles work table to and from broaching posi- controlled high speed. Cushioned, 180° harmonic of crank eliminates starting and stopping shocks tively locks table under pre-load in broaching posi- arts do not have to be clamped before table moves. tic clamping and unclamping of work is easily applied.

DIAGRAM ILLUSTRATING
HIGH-SPEED HARMONIC TABLE MOTION



OTHER FEATURES

These and other features such as long table travel for straddle broaching, hardened and ground ways with adjustable gibs which prevent tilting and automatic pressure lubrication to vital points also contribute to the outstanding performance of Oilgear Surface Broaching Machines. Write for descriptive bulletins. THE OILGEAR COMPANY, 1573 W. Pierce St., Milwaukee 4, Wis.

Oilgear Fluid Power

The crystal searching unit in the operator's left hand transmits supersonic waves to the circular viewing screen. The wave pattern reveals the presence and location of any defects in the inner structure of the steel.

Supersonic Inspection

guards the quality of Bethlehem Tool Steel

Millions of electrical impulses per second probe into billets and bars of Bethlehem Tool Steel, searching for possible voids, piping, or other deviations from high quality. A unique instrument, known as the Supersonic Reflectoscope, makes possible this remarkable examination of a tool steel bar's internal condition by sending high-frequency sound waves through the steel and "bouncing" them back.

Bethlehem applied this inspection method to tool steel and established its reliability over a period of nearly four years. It is especially useful where our past experience has indicated the value of this additional precaution in certain bar sizes.

To users of Bethlehem's fine tool steels, supersonic inspection means a big step forward in the direction of additional quality control. It gives real assurance of soundness, cleanliness, and freedom from flaws in the cross-sections of tool steel bars.

When you need tool steel . . . no matter what the application may be . . . you can count on the ultimate in quality by specifying Bethlehem. The complete range includes: Carbon, Oil- and Air-Hardening, Shock-Resisting, High-Speed and Hot-Work grades.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Bethlehem SUPERSONIC TESTED **Tool Steel**

Announcing

BESLY

HIGH SPEED TWIST DRILLS *and* REAMERS

Besly is proud to announce as additions to its line of precision cutting tools these new high speed drills and reamers—available in a complete range of types and sizes.

Like all Besly products, they are manufactured to meet industry's most exacting requirements. They can be depended upon for economical, long-life performance . . . for more efficient production. Get full details from your Besly Distributor today.

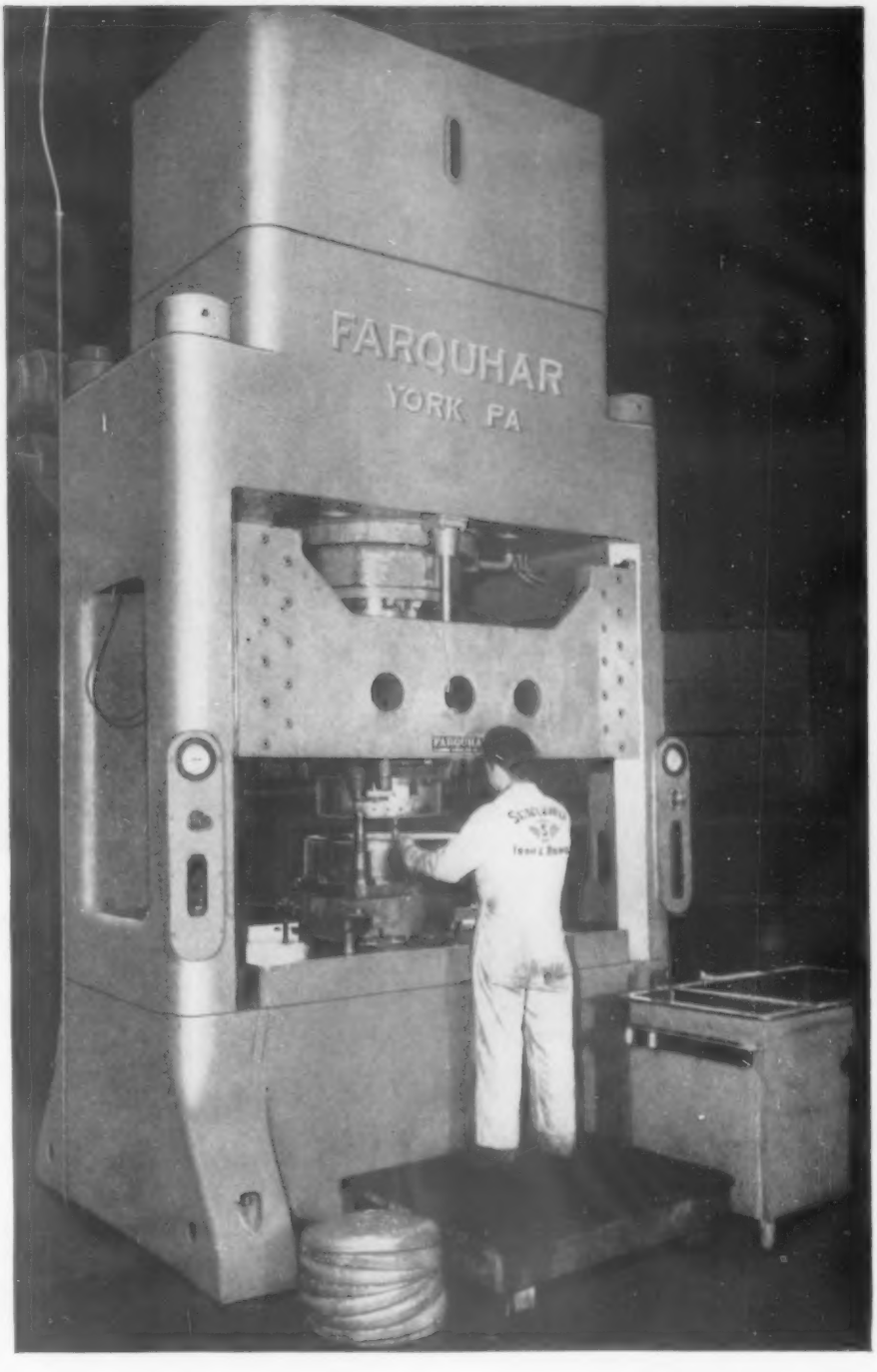
BESLY

BESLY HIGH SPEED TWIST DRILLS AND REAMERS • BESLY TAPS
BESLY TITAN ABRASIVE WHEELS • BESLY GRINDERS AND ACCESSORIES

CHARLES H. BESLY & COMPANY, 118-124 N. Clinton St., Chicago 6, Illinois

FACTORY: Beloit, Wisconsin

Pacific Coast Plant Betters Production of Hot Water Tanks with FARQUHAR HYDRAULIC PRESS



NO production time has been lost for maintenance purposes since the day this 500-ton Farquhar metal-forming press was installed at the Seidelhuber Iron & Bronze Works, Seattle, Washington.

The Farquhar Press is used for forming heads for hot water storage tanks. Better production is obtained because there has been no machine "down-time" with the Farquhar Press on the job. Smoother operation and improved quality are obtained because Farquhar's hydraulic cushion eliminates wrinkling and tearing.

The Seidelhuber plant is only one of hundreds of users throughout industry who depend on Farquhar Hydraulic Presses for better production. In the shop or on the line, you get the benefits that Farquhar builds into every press: (1) Rapid advance and return of ram *for faster work*. (2) Extra length guides on moving platen *for greater accuracy*. (3) Finger-tip controls *for easy, smooth operation*. (4) Positive control of speed and pressure on the die *for longer die life*. Farquhar builds hydraulic production presses in all sizes and capacities for all types of industry.

Farquhar engineers are ready and willing to help solve whatever production problem you may have, with a hydraulic press that will do your job faster, better and cheaper. Why don't you give them a call?

Farquhar Hydraulic Press, *forming heads for hot water tanks. Nine gauge steel blank material (30" x 30") is used; head is 26" diameter. Only one man needed to place material in press.*

Send for Catalog

Farquhar
HYDRAULIC PRESSES
for Bending - Forming - Forcing - Straightening - Hobbing - Assembling
Drawing - Extruding - Joggling - Forging - and other Metalworking Operations

A. B. FARQUHAR CO.
Hydraulic Press Division
1519 Duke St., York, Pa.
Please send me a Farquhar Hydraulic Press catalog.

Name .....

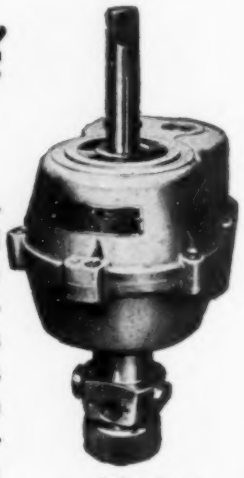
Firm .....

Address .....

TOOL UP FOR THRIFTY TAPPING and THREADING

Ettco-Emrick TAPPERS

attached to your drill press spindle offer a low-cost way to tool up any drill press for a wide range of tapping needs. Hair-trigger sensitive clutch protects taps and work. Ettco Tappers are ideal where cost, production and accuracy are important factors. Quill clamps are available for maximum rigidity.



7 sizes for No. 0 to 1" Taps

Ettco-Emrick THREADERS

5 sizes for No. 6 to ⅝" dies

are standard Ettco Tappers fitted with acorn or button-type die-holders and dies. They put threading work on a high-speed production basis. Their highly sensitive action assures accurate, low-cost work.

WRITE FOR BULLETIN NO. 22 — FREE

It gives details and prices on Ettco-Emrick Tappers and Threaders, which are available at leading mill supply houses throughout the country.

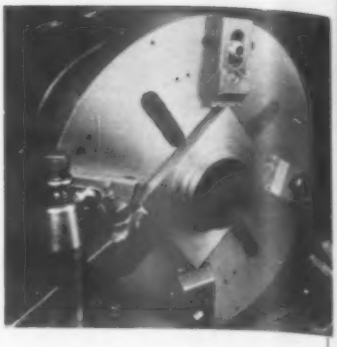
ETTCO TOOL CO.

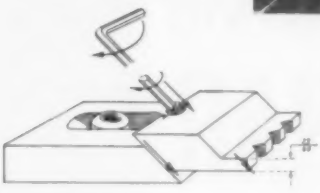
593 Johnson Avenue, Brooklyn 6, N. Y.

Boston, Mass. • Portland, Conn. • Detroit, Mich. • Chicago, Ill.

DRILL & TAP CHUCKS • TAPPING ATTACHMENTS
MULTIPLE DRILLING & TAPPING HEADS
DRILLING & TAPPING MACHINES

Save time and money with these new side-gripping self locking jaw clamps





J&S Jaw Clamps hold all sizes and shapes of work-pieces tightly against face plates of machine tools. Clamp is self-locking and full surface of work ⅜" high or over may be machined without interference, because the jaws grip the work-piece on the sides. These clamps facilitate controlled centering adjustment—secondary operations are unnecessary — they eliminate different length studs and blockings — tested for two-ton down pressure. Send for details.

J&S TOOL CO., INC.

485 Main Street, East Orange, N. J.

Representatives in Principal Cities

SPECIAL CUTTING TOOLS MADE PROMPTLY . . .

Accurately

CARBIDE TIPPED OR H.S. STEEL

Special cutting tools of all types are a specialty at Detroit Reamer & Tool Company. All carbide-tipped tools are supplied with high speed steel bodies.

Included in our modern equipment are Circularity-Grinding Attachments. Circularity relief can be ground on any special tool, when specified, at no additional cost.

Our engineering department is at your disposal to help solve cutting tool problems.

D R & T COMPANY

DETROIT REAMER & TOOL CO.

Mfrs. of Special High Speed Cutting Tools

2830 East 7 Mile Rd. Detroit 12, Michigan

Economical for 3 operations or 33

High production of these 2 drilling & tapping machines cuts unit costs to pennies

Dear Sir:

These machines need expensive tooling. Yet unit costs are amazingly low. The reason is high production.

The oil heater part has 33 operations from 6 directions. Three units at compound angles move forward to operate and then retract so that the fixture can index. Ten identical double fixtures hold 2 parts each. Cost: 1-8/10c per part.

The conn. rod is a steel forging. The milling operation is 42° away from the drilling. The machine grosses 590 parts an hour by 1) holding 2 parts in each fixture and 2) drilling the .125 hole in 2 steps (50.5 FPM). Cost: 9/10c per part.

These costs include man and machine on this basis: National average wage rate. 80% efficiency. Amortize the whole machine cost over its first 6000 hours. (No power or overhead.)

AN OLD STORY

Such low unit costs are old stuff to many high production men. They figure that certain automatic machines can pay for themselves in 1 to 3 years. That is why they buy them. General purpose equipment can do the operations, but the cost is too high. They can move it to one side and install automatic machines with space left over.

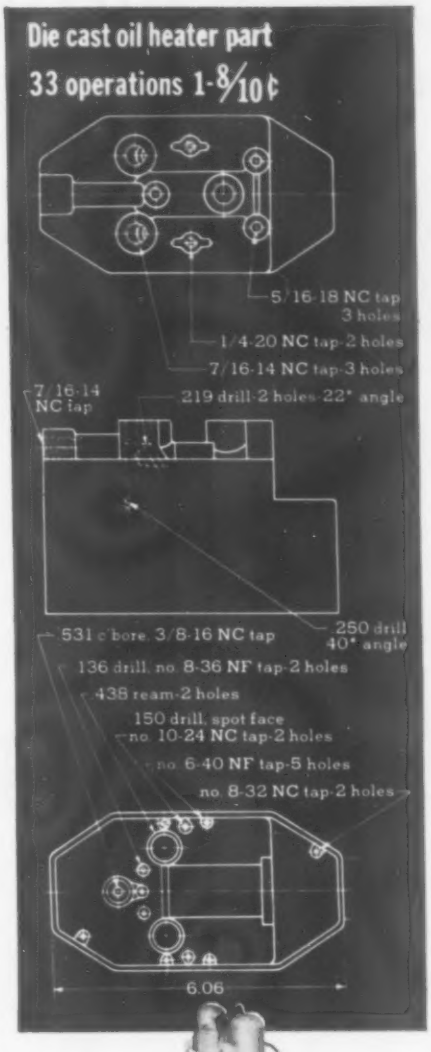
A NEW STORY

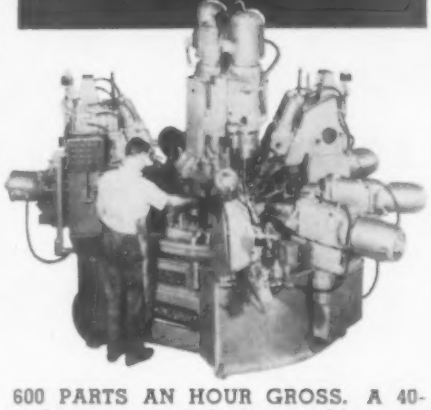
Speaking of installation, here is a remark by one production official. Ten Kingsburys had just arrived. By noon 5 of them were in production. "You know why I like Kingsburys? They run." (He ought to know. Since the war that plant has installed 46 Kingsburys costing $689,204.)

Don't let this bragging scare you. At first most firms ask us to quote only 1 or 2 machines. We will be glad to settle for that. Mr. L. A. Carll is the man to ask. Send him a print showing the operations and hourly output you need. Or ask him for free bulletins showing 40 setups.

Sincerely,

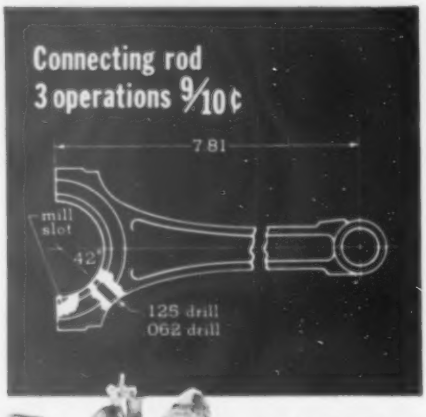
Kingsbury Machine Tool Corp.
10 Laurel St., Keene, N. H.





600 PARTS AN HOUR GROSS. A 40-inch automatic indexing machine performs operations from 6 directions in 2 chuckings. It has 12 automatic units — 7 on the base, 3 on angular columns and 2 on the central column.

- The horizontal units use multi-spindle heads to operate on the 14 holes in the bottom view (1st chucking) and tap 7/16-14 in the center view (2nd chucking).
- The units on the angular columns operate in 4 steps: 1) The whole unit moves forward by means of an airdraulic cylinder that the feed cam controls: 2) The plate with the tool guide bushing is inserted into the work: 3) The unit performs its automatic cycle: 4) The unit retracts so the fixtures can index. Time: 3.75 secs.
- The vertical units use multi-spindle heads to tap the 8 holes in the top view (2nd chucking).
- Clamping is automatic. In the first chucking an air cylinder at station 1 clamps each fixture. In the 2nd chucking the units clamp the work.
- Control is all-electric and meets the Machine Tool Electrical Standards for Automotive Use. The controls are in a separate NEMA type 1A cabinet that stands near the machine (not shown).



590 PARTS AN HOUR GROSS. To meet this rate with a steel forging, each fixture holds 2 parts. Each time the table indexes, 2 parts are finished. Two units drill the .125 hole in 2 steps to keep that operation within the allowed cycle.

- The fixtures are automatically clamped and unclamped as the table indexes.
- The milling units are on the radial center line of the machine. The drilling units are 42° left of this line.
- There are 6 identical double fixtures on a 20-inch index table.
- Drilling units with standard milling attachments mill the slot.

KINGSBURY

AUTOMATIC DRILLING
AND TAPPING MACHINES
for Low-Cost High Production

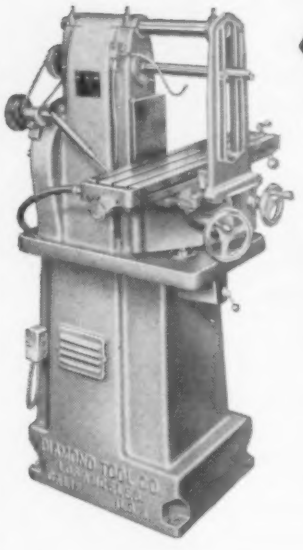
Automatic DRESSOMETER DIAMOND ACTUATOR

rotates diamond tool
22½ deg. with each complete pass
across wheel face, maintaining most effective
cutting edge and constantly sharp diamond.
Adaptable to all grinders. Simple to install.
Longer diamond life and more pieces
per dressing guaranteed.
Write for catalog.

J. K. SMIT & SONS, INC.

Gen'l Offices & Plant: MURRAY HILL, N. J.
6400 Tireman Ave., Detroit 4, Mich.
In Canada: 129 Adelaide St. West, Toronto, Ont.

DIAMOND
MILLING MACHINES



MODEL M-30

...*New* SILENT CHAIN DRIVE assures positive cutter rotation even at slowest spindle speeds!

Write FOR COMPLETE CATALOG

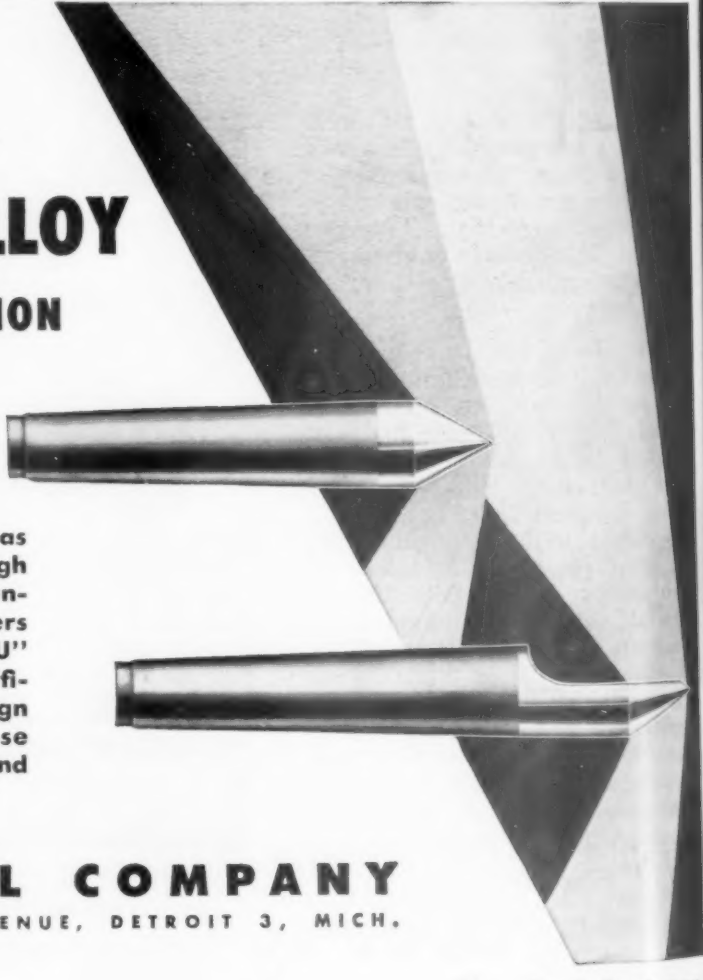
DIAMOND MACHINE TOOL COMPANY
3427 EAST OLYMPIC BLVD., LOS ANGELES 23, CALIF.
OFFICE AND WAREHOUSE IN CHICAGO

For really *tough* going—

GORHAM M-40-U ALLOY

RESISTS WEAR AND ABRASION

3 to 10 times longer!



So superior is this alloy that *by actual test* it has shown results 3 to 10 times better than high speed steel and other alloy materials for centers. Standard "M-40-U" alloy tipped centers can be furnished from stock. Special "M-40-U" alloy centers can be furnished to your specifications, or our engineers will help you design special centers to fit your needs. Choose GORHAM "M-40-U" for top performance and long wear.

GORHAM TOOL COMPANY
14400 WOODROW WILSON AVENUE, DETROIT 3, MICH.

A Snap Gage that is way out in front and at a price that is right

For years you've seen snap gages — both with and without Indicators — that really do *not* answer your needs. You've wanted a simple gage that was foolproof, rugged, and easy to handle — *and at a right price.* Here it is: Federal Model 1000! All our research, all our know-how in gage-making, all your wants, likes and dislikes, your demands and your gripes have been carefully considered to make this an outstanding Gage. Model 1000 is "IT", the right gage at the right price.

There are no tricky gadgets — Model 1000 is simple, easy to set and easy to use. It's rugged and fully guarded to withstand the roughest handling. It feels and handles like an old fashioned conventional gage but it's years ahead in design and performance. Model 1000 is completely new and up-to-date in every detail . . . newer even than any other Indicating Snap Gage.

Model 1000 has everything — visibility, positiveness, simplicity, lightness, toughness — it's dead to temperature changes and above all *accurate.* You'll like it when you see it and you'll like it more when you use it.

No other Indicating Snap Gage can match Model 1000 in usefulness. Five sizes cover the full range from 0 to 6". Think of the number of old-style conventional gages each Model 1000 can replace — think of the savings, too!

Federal Model 1000 All-Purpose Snap Gage does a *better* job at less cost. Its price will surprise and please you. Send coupon attached to your letterhead for complete descriptive bulletin and price of this definitely modern Snap Gage.

MODEL 1000 SERIES

— THE SNAP GAGE YOU WILL EVENTUALLY USE!

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SEND THIS COUPON TODAY

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1104 I Eddy St., Providence 1, R. I.
Please send me complete information on the new Model 1000 Series Snap Gage:

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..to fit your needs.

Wise executives have found out that V&
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the three-ton minimum to 105-ton maximum
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the answer to profitable, highspeed product
Each and every V&O POWER PRESS, be it
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Here is the latest information on low cost machining. Th 32-page, heavily illustrated catalog contains complete speci cations and features of Cincinnati Shapers. Many practic and useful shop applications are illustrated. Cincinnati Shape give you maximum versatility with minimum investment a minimum tooling cost. Write for your copy.

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Please send me a copy of Catalog N-5M on Cincinnati Shapers

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Company.....

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TALIDE METAL MEETS EVERY REQUIREMENT

SOLID BAR STOCK

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2 to 3 TIMES FASTER!

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Faster cutting than other tools, Talide Tools and Tips wear much longer and require only infrequent redressings. Same long-run advantages whether you machine steel, cast iron, non-ferrous metal or non-metallic materials.

The quality of Talide Tools never varies. Made from the hardest man-made metal, each Talide Tool and Tip has the same metallurgical consistency.

For lower costs, try Talide Tools and Tips . . . plastic-dipped for protection in shipment or storage. Available in 24 hours or less from warehouses in Newark, Youngstown, Detroit and Chicago.

Send for engineering-style catalog 48-T "Standard Talide Tools and Tips"

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YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS

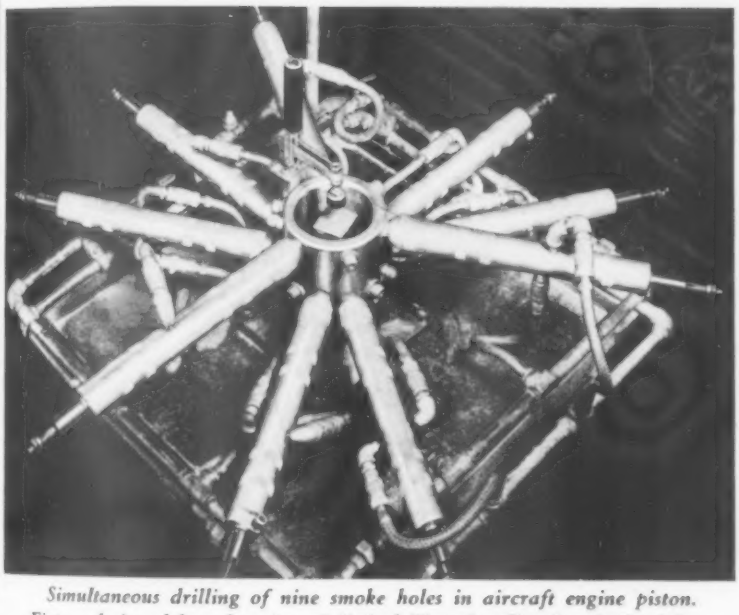
Index of Tool Engineer Advertisers

SEPTEMBER, 1949

KELLER AIRFEEDRILLS

PRODUCTION DRILLING

with units that can be carried to the job



Simultaneous drilling of nine smoke holes in aircraft engine piston. Fixture designed for relocation of Airfeedrills to handle other similar jobs.

Expensive Jigs or Fixtures Are Not Needed

The Airfeedrill combines the efficient Keller air drill, an air cylinder, hydraulic dashpot, feed control, and stroke adjustment. These units are assembled into a rigid housing that can be "hung by the nose" from an inexpensive jig or fixture in any position or plane.

Available in five standard sizes. Drill to ¾" diameter steel; 1" in aluminum, brass, plastics.

Built as self-contained units, Airfeedrills are arranged for quick locking in jig bushings for progressively drilling a series of holes... useful where the workpiece is too cumbersome to bring to the drilling unit.

Airfeedrills are also adaptable to multiple drilling setups, where the units are permanently mounted in a fixture, for simultaneously drilling as many holes as desired . . . useful where small workpiece can be handily jig loaded.

4 GREAT ADVANTAGES

1. **Easy and economical to set up initially.**
2. **Fixture setups need not be permanent.**
3. **Can often be used in existing fixtures by simply mounting the Airfeedrills in bushing holes in fixture.**
4. **Fast and accurate control of stationary drills when equipped with Keller Four-Way Air Valves.**

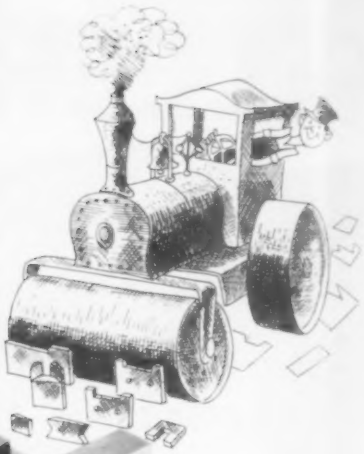
K KELLER TOOLS

KELLER

Pneumatic Tools

KELLER TOOL COMPANY, GRAND HAVEN, MICH.

Flatten Your Tool Costs!



Make your own Jigs, Dies, Gages, Punches Templates, and Small Parts...

...use SIMONDS Flat Ground Stock & Ground Die Steel

100% QUALITY-CONTROLLED in Simonds own steel mill is this *oil-hardening* tool steel . . . uniformly annealed for easy cutting, machining and punching. Doesn't have to be ground to size . . . dimensions are uniformly accurate, edges finished, ends milled, surfaces micro-finished. No deformation in heat-treating . . . so you don't lose the hours and material put into punches and dies before hardening.

156 sizes are regularly carried in stock, each individually packaged, fully protected from rusting and scratching, with dimensions and heat-treating instructions clearly given. Order from your Industrial Supply Distributor.

BRANCH OFFICES: 1350 Columbia Rd., Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Cal.; 228 First St., San Francisco 5, Cal.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Wash. *Canadian Factory*: 595 St. Remi St., Montreal 30, Que.

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it's 1-2-3-!

...FOR FASTER DIE SET DELIVERY

1

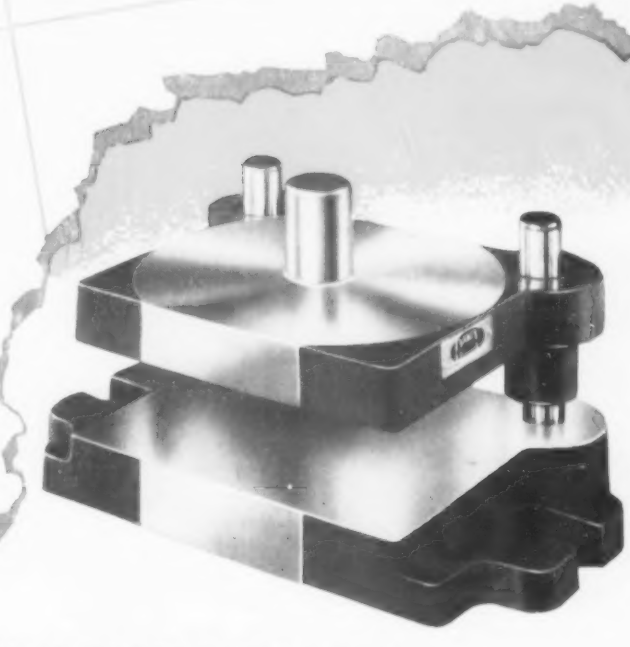
Check your Danly catalog. Select the standard die set that meets your requirements from the almost unlimited range of types and sizes available for prompt shipment.

2

Phone or wire your nearest Danly branch. A nation-wide system of assembly branches in major tool and die centers is at your service. Choose the one most convenient to you from the list below.

3

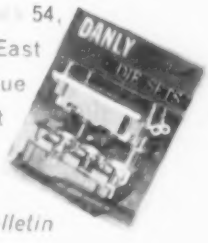
Your standard Danly Die Set is on the way—**promptly!** All Danly assembly branches are completely stocked with all standard die set parts. The set you want is assembled and shipped immediately upon receipt of your order.



WHICH DANLY BRANCH IS CLOSEST TO YOU?

*Chicago 50, 2100 South 52nd Avenue *Cleveland 14, 1550 East 33rd Street *Dayton 2, 990 East Monument Avenue *Detroit 16, 1549 Temple Avenue *Grand Rapids 2, 113 Michigan Street, N.W. *Long Island City 1, 47-28 37th Street *Los Angeles 54, Ducommun Metals & Supply Co., 4890 South Alameda Milwaukee 2, 111 East Wisconsin Avenue Philadelphia 44, 18 West Chelten Avenue *Rochester 4, 16 Commercial Street

* indicates complete stocks



See how Danly's special die set machining service can reduce your costs...write for this free bulletin

DANLY

PRECISION DIE SETS...standard and special

DANLY MACHINE SPECIALTIES, INC.

2100 South 52nd Avenue, Chicago 50, Illinois

OVER 25 YEARS OF DEPENDABLE SERVICE TO THE STAMPING INDUSTRY

Nothing like

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with the

EXCLUSIVE

NO CLUTCH . . . NO BRAKE

HYDRA-NEW-MATIC DRIVE

● Wales Fabricator punches, notches, nibbles and blanks up to 1/4" mild steel. This Fabricator is so revolutionary there is nothing like it. Yes, it is revolutionary in design . . . engineering . . . construction . . . and operation, BUT backed by over 8 years of development and over 3 years of continuous testing and operating under actual production conditions.

Wales *exclusive Hydra-New-Matic Drive* is unique in its simplicity of design and operation,— so unique, in fact, that vibration and noise is practically eliminated at 165 strokes a minutes. This drive plus the Wales *patented "Quick-Change" System* makes possible startling, "never-heard-of-before" time study figures.

IT'S TOO BIG A STORY TO TELL ON THIS PAGE, SO WRITE FOR FULLY-ILLUSTRATED, FUNCTIONALLY-COLORED CATALOG 10-A AND TIME STUDIES THAT WILL "KNOCK-YOUR-HAT-OFF".

WALES-STRIPPIT CORPORATION

George F. Wales, Chairman

393 PAYNE AVENUE, NORTH TONAWANDA, N. Y.

(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONTARIO

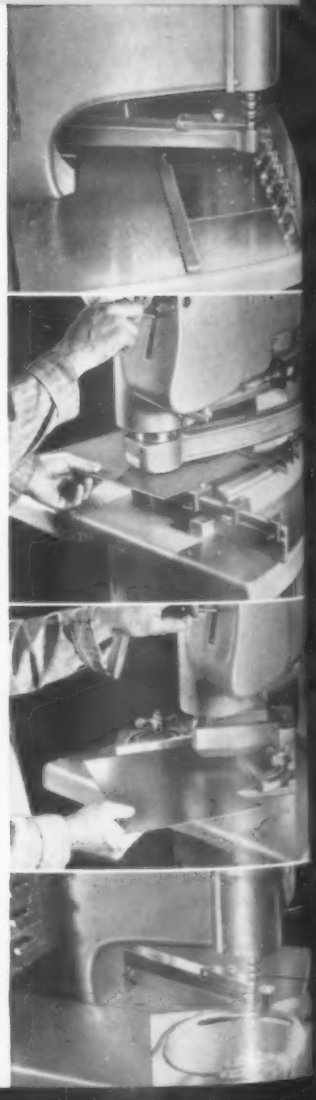
Specialists in Punching and Notching Equipment

QUICK CHANGE HOLE PUNCHING

HOLE PUNCHING WITH WALES UNITS

NOTCHING

NIBBLING



NO CLUTCH
NO BRAKE BUT SMOOTH
INTERMITTENT OPERATION